

STRUCTURAL
SERVICE BOOK

VOL. I—1917

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STRUCTURAL SERVICE BOOK

Volume I

A Revised Reprint from the Twelve Issues
for 1917 of
The Journal of the American Institute of Architects
Structural Service Department

D. KNICKERBACKER BOYD, *Editor*

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Original Announcement of the Structural Service Department

D. KNICKERBACKER BOYD, *Associate Editor*

From the Journal of the American Institute of Architects, October, 1916

UNDER the above heading, the Journal announces that it is ready to take one more step toward the complete ultimate fulfilment of the purpose for which it was founded. It proposes to render not only an invaluable service to architects, but an immeasurable service to the whole art and trade of building. During a period of many years, Mr. Boyd has steadily pursued the most arduous task imaginable, in reading, classifying and cataloguing reports, bulletins, proceedings, and thousands of manufacturers' catalogues, with the purpose of discovering how best to provide for the accomplishment of these things:

First: Bring into active co-relation with the work of the Institute every allied effort which is being made to standardize building methods and materials.

Second: Give to architects a monthly classified index of all such work easily available and at the minimum of cost.

Third: Encourage architects to make use of all standardizations whenever they have been reached and passed upon by competent organized bodies.

Fourth: Encourage manufacturers to continue, through properly constituted bodies, their efforts toward solving problems of standardization, to the end that the resultant savings may reduce the cost of building.

Fifth: Through the quick and orderly dissemination of all such information, bring the architect, the producer, and the manufacturer into the closest possible contact, without loss of time and with the minimum of expense to each.

How is this to be done? We shall outline the work very fully in the next number of the Journal, and begin the actual publication of

material in the number for January, 1918. It was thought necessary to begin with a new volume, since the work has been planned to extend over a year, and then to be entirely recovered each succeeding year, with such intermediate attention as may be required by happenings of sufficient importance.

We cannot let this announcement appear without recording our good fortune in finding so willing and so able an editor. Mr. Boyd's devotion to architecture needs no word from us. His labors are known, and their value recognized, not only throughout the Institute, but by members of other professions as well. He takes up this work in the Journal with that same spirit which has carried him through the dry and tedious preparatory work of study and analysis, and which has equipped him with a skill and knowledge not elsewhere to be found. We are very happy in feeling that he has been willing to join with us in our efforts to bring the Journal to the full performance of its mission—the greatest ultimate good for architecture.

Thus, beginning with the issue of January, 1918, a part of the Journal will begin to grow, month by month, into a history of the continuous advance in building methods—not a personal or prejudiced narrative but a classified and orderly arrangement of the history actually unfolded through the work of recognized societies. We believe that the importance of this undertaking scarcely can be magnified, and that members of the Institute should take every opportunity of pointing out the value of this work to everyone interested in building materials and methods, and of making it known that anyone may subscribe to the Journal.—THE EDITOR.

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A Description of the Structural Service Idea

From the Journal of the American Institute of Architects, November, 1916

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THE purpose of the Structural Service Department was briefly outlined in the Journal for October. From all sources instant approval of the plan and scope of the Department has been received; likewise, assurances of coöperation from individuals, governmental departments, societies, associations, and other potent allied agencies.

Such coöperation will afford the surest foundation upon which so far-reaching a work can be carried—not to completion, but to the point of constant highest usefulness. For, the sheltering of humanity, primarily one of the three simple necessities of life, has, through slow evolution, grown into one of the most complex requirements of modern civilization, involving activities—governmental, professional, technical, commercial and industrial.

In these, resources are being developed, ideals promulgated, researches and tests made, standards determined, methods of production and manufacture studied and improved, machinery and human labor developed and, we wish we could as truthfully record, all forms of art encouraged, to their utmost. All this is being done, with some coöperation, but without that coördination which is demanded in an undertaking so vast and so vital to humanity.

This lack of coördination has been apparent to no one more than to the architect, who exercises the largest selection of materials.

To do so properly he should be informed upon the results of the researches, experiments, and conclusions of those best qualified to pass upon the materials and methods employed. Yet such is not the case, although individuals, firms, associations, educational institutions, and others in turn undoubtedly desire to have such activities known and the results made most available, as is evidenced by the flood of bulletins, reports, proceedings, pamphlets, catalogues, and circulars—in all shapes and sizes—flowing in a steady stream, and only vaguely revealing their source, use, or destination. Not

only on the part of the architect but on the part of the public there is too little realization of the services rendered its citizens by the National Government, certain departments of which deal with the source, nature, quality, and durability of materials entering into all phases of building construction. There is a lack of knowledge of what is being done constantly by professional, technical, and other associations; an inadequate appreciation of what the engineering fraternity has long been doing in standardizing constructional materials and processes—a task which architects are not now unwilling to share as fully as possible.

And, lastly, there is not due appreciation of the fact that conscientious producers and manufacturers are constantly striving to perfect their output and to cause a better understanding as to the use, application, and protection of each; for, as has been pointed out in the current Report of the Bureau of Standards:

“The time is not far distant when it will be required that all materials bought or sold shall be as represented, but it should be kept in mind that this is impossible except in the case of those materials where proper standards of quality and methods of measurement have been developed. It must not be assumed that the purchaser or user is the party principally benefited in the development of such standards; on the contrary, the manufacturer, first of all, is interested in the quality of all things which affect the quality of his product.” The Report also states: “It is upon quality as well as upon price that competition must finally depend, whether in domestic or foreign commerce. The use of exact methods and scientific results is the greatest factor in the improvement of quality, efficiency or the development of new industries.” How true this all is!

It is not at all remarkable that we have failed to absorb all the information, for it has been a practical impossibility to preserve this enormous amount of literature or to keep track

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of even its most necessary portions. The time alone consumed in merely glancing through it all has, in the aggregate, caused a great economic waste, to say nothing of the waste in paper, printing, and distribution because of the inadequate results.

The Editor of this Department determined to measure the volume of this stream, dam it up, and study the consequent accumulation. He decided to follow back to the source each branch of information and to endeavor to make it available to all who need to draw upon it.

The result is the present plan of the Structural Service Department which is offered as a solution, or an outlet, through the Journal of the American Institute of Architects as the one logical medium for a centralized source of information.

Affording, as the Journal does, twelve opportunities to cover the whole field in one year and reach architects, constructors, and all other interested persons, it has been but natural to devise a classification, which has now been worked out, dividing all building activities into twelve basic parts. The intention is to present in the twelve issues of each year, as complete a résumé as possible of all governmental, professional, technical, commercial and industrial activities concerning the art and science of building. In doing this an attempt has been made to separate the construction of a composite building into twelve stages of progress. At the same time the fact has been kept in mind that no matter how well devised a classification for reference, filing, or ultimate binding might result, the first essential is to facilitate instant reference, to have the contents of each number as nearly as possible correlated according to materials and industries on an easily remembered topical basis. In any particular issue will be found not only an index to

the current and preceding issues, but a bibliography of the principal reference books and publications relating to each subject treated, statements concerning previous progress and current activities in each industry, the work of governmental departments, societies, associations, and other bodies relative to each of the various activities, materials or products mentioned, with a description of the functions of each of such important agencies and the standards evolved. The Industrial Section in each classification will contain informative matter relating to the materials and manufactured products in each particular industry, which will be arranged to describe the character and intended uses, methods of application, and protection, coupled with detailed drawings and suggestions as to accessorial details of installation and cross-references from one to the other. Each issue will bear a serial number, from one to twelve, with subdivisions under each classification, in connection with which the index will afford the means for instant reference to any subject or issue.

No one realizes more keenly than do the Editors the comprehensive and laborious character of the work the Journal is undertaking. But the work must be done. In the doing of it we expect to make mistakes, to be criticized, and to learn. Nevertheless, the work must be done. Are we not justified in believing that all those interested in the building industry will look kindly upon our endeavors and help us, by coöperation, suggestion, and constructive criticism, to make a worthy and lasting contribution to the art and science of building—a contribution which shall not only make for higher standards and better buildings, but which shall also add its mite in the making of a better citizenship and a finer national life?

An Appreciation, January 1, 1918

On the completion of the first year's work, the Editor of the Structural Service Department desires to express his gratitude to those who have throughout the year so unfailingly given their assistance in the compilation of the material within these pages.

These include officials of Government Departments, of the professional and technical associations and of organizations of producers and manufacturers throughout

the country. They include architects, engineers, constructors and others who have reviewed and all those who have followed the work. They also include Charles Harris Whitaker, the Editor of the Journal, R. J. Friedhoff and V. D. Abel of the Associate Editor's Staff.

The fullest coöperation in the further development of the work will be welcomed during the coming year.

D. KNICKERBACKER BOYD, *Associate Editor.*

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GENERAL INDEX

It is hoped that this necessarily inadequate index will be of assistance in locating, within this book, the references, including those in the Industrial Section,* to countless activities in the structural field, as well as to a vast array of informative data, and that it may emphasize the necessity for coördination and for improvements and additions in subsequent years.

Wherever words in the Index appear in *Italics* these indicate that the references pertain to practice recommended, specifications issued, or standards adopted by various authorities.

The alphabetical-numerical designations are "finders" for reference purposes. For example: 9D3 will be found under the ninth month—or September—designated as Serial No. 9—and D represents the fourth main subject treated, as A, B and C precede it—and 3 indicates that the reference is third under this subject division.

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Structural Service Book

D. KNICKERBACKER BOYD, *Associate Editor*

A revised reprint from the twelve issues for 1917 of The Journal of the American Institute of Architects' Structural Service Department, conducted in connection with professional societies and organized bodies working toward the improvement of building materials and methods, and the following Committees of the Institute:

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G. F. A. BRUEGGEMAN St. Louis
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ROBERT STEAD Washington
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QUANTITY SYSTEM

SULLIVAN W. JONES, *Chairman*,
Washington, D. C.

*(Each Chapter has a corresponding member who is chairman of the Chapter Subcommittee.)

Foreword

HERE begins the annual review of structural activities throughout the United States with particular reference to the standards adopted or under consideration by the various societies, associations or other potential agencies whose work concerns itself in any way with the materials which enter into building construction, the methods and safety of their production, manufacture and erection. Brief reference is made to standardizations by foreign governments and institutions.

Through this work the Editors have the desire to help in perfecting the art and science of building and in advancing the standing of the professions, trades, and crafts which are concerned therewith. This will require the fullest coöperation of all those whose interests are in common with this creed. In thanking those

officials of the Government and of the professional, technical and other associations with whom we have thus far come in contact for their assistance which has been so generously given, we bespeak that further coöperation of all others which will be so necessary for the fullest fruition of our plans. In this we include our readers, whose indulgence we ask for any omissions which may be made this year, due to the magnitude of our task, and we invite such suggestions, advice and comments as will help us to do better.

Only a limited number of references in each industry can be given and a part of the service of this Department will be to furnish any inquirers with additional sources of information, titles of other publications, names of authors and publishers, cost of volumes, and to provide any other information possible for which purpose address The Journal of the American Institute of Architects, The Octagon, Washington, D. C.

Serial No. 1

JANUARY, 1917

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| 1B Testing, Inspection and Research Facilities. | 1E9 Concrete Fills, and Various Top Coats. |
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| | 1F8 Preservation of Iron and Steel. |

STRUCTURAL SERVICE BOOK

Serial numbers and alphabetical designations are for reference purposes only

1A1 Foreign Governments, Institutions and Architectural Societies

1A1a

The importance of maintaining scientific institutions for the investigation and standardization of materials, including those entering into building construction, has been recognized by the leading countries of the world. The most notable organizations of this character are:

In England the Engineering Standards Committee of Great Britain, which publishes the British Standard Sections and the British Standards Specifications, the latter dealing with materials and methods of testing materials. This institution is liberally supported by Royal Grant of the British Government, and by the national engineering societies. Great Britain also maintains the National Physical Laboratory.

The German government maintains the Königliches Material-Prüfungsamt, a large institution devoted to the investigating and testing of structural, engineering and other materials. In connection with the leading technical high-schools of Germany laboratories are maintained for conducting investigations of building and other materials.

In France there is the Laboratoire des Ponts et Chaussées, and the Laboratoire Municipale d'Essais des Matériaux.

These governments also maintain laboratories whose functions include matters pertaining to scientific and technical standards, physical constants, weights and measures and to some extent the properties of materials. Among these are:

In Great Britain the Standards Department of the

Board of Trade in charge of the standards and inspection of trade weights and measures.

In France the Laboratoire de Conservatoire National des Arts et Metiers.

Germany maintains the Normal-Eichungs Kommission, and the Physikalisch-Technische Reichsanstalt.

It is generally recognized that these institutions have been important factors in the industrial progress of these countries. These and similar institutions coöperate directly or indirectly with the International Association for Testing Materials, with headquarters at 50 Nordbahnstrasse, Vienna II, Austria. This association, developed from a conference of a small group of workers in experimental engineering held in Munich in 1882; its objects are "the development and unification of standard methods of testing; the examination of technically important properties of materials of construction and other materials of practical value, and also the perfecting of apparatus used for this purpose."

In the United States, as will be noted below, the Bureau of Standards combines the functions of many of these foreign institutions and maintains coöperative relations with other governmental departments and with the various professional, technical, commercial and other organizations.

1A1b

For lists of foreign architectural societies, see Kidder's Pocket Book, 1916. Pp. 1698-1703.

1A2 Bureau of Standards, Department of Commerce, U. S. A.

Authorized by Act of Congress, March 3, 1901; organized July 1, 1901

Director: Samuel W. Stratton, Bureau Laboratories, Washington, D. C.

Publications:

- (a) Annual Report of the Director. Limited number for free distribution upon request to the Bureau.
- (b) Scientific papers, (c) technologic papers, and (d) circulars: Published as investigations warrant; obtainable upon application to the Bureau or the Superintendent of Documents at Washington, at prices quoted or without charge if no price is given.
- (e) Miscellaneous Publications: Reports of weights and measures, conferences, metric charts, tables and equivalents, obtainable upon application to the Bureau.

(NOTE: For separate lists of these publications of a special interest to those concerned with structural matters, and for extracts from Annual Reports, see notes in connection with each industry.)

Laboratories:

Main Laboratories: Washington, Pierce Mill Road, near Connecticut Avenue.

Branch Laboratory: Pittsburgh, Pa., temporarily located in buildings of the War Department, Arsenal grounds.

The Bureau is authorized to deal with: Standards of measurement, of values of constants, of quality, of mechanical performance, and of practice.

A standard of quality for a given material necessarily takes into account the purpose thereof; too low a standard results in losses, poor efficiency, and even loss of life; too high a one may result precisely in the same thing; that is to say, the material must be suitable for the pur-

pose intended. The Bureau's investigations are to enable the user of materials, first, to select intelligently the material best suited for the purpose; second, to specify it in terms which the producer cannot mistake; and third, to make the necessary tests to ascertain whether the material supplied is in accordance with the specifications.

The Bureau does not compete with private testing laboratories, but endeavors to assist them by the development of standard specifications, methods of measurement, and other matters where uniformity is desirable.

The time is coming when all materials bought or sold must be as represented. This is impossible except where proper standards of quality and methods of measurement have been developed.

Standards of practice are generally involved in the enactment of laws when technical and scientific matters are concerned, in ordinances regulating public utilities, and in the establishment of building and safety codes. Like standards of performance, they are dependent upon standards of measurement and of quality, and are of the most vital importance to the welfare and safety of the public. In a field so broad, the Bureau can touch only upon the more important aspects of the work—where national uniformity is desired—fields which cannot be covered efficiently in private laboratories.

The maintenance by the Government of correct standards of measurement, quality, or performance, calls for continuous scientific and technical investigations of the highest grade, the most competent expert services and the best scientific equipment. Then there still remains the

serious problem of making the results available and useful to the public, a part of which service the Journal will be able to effect through its columns. But the Bureau's activities are not devoted principally to the interests of the user or consumer, for its work most deeply concerns manufacturers, who are fundamentally concerned, directly or indirectly, with the improvement of methods of production or quality of output, for it is upon quality, as well as upon price, that competition must finally depend, whether in domestic or foreign commerce, and the use of such methods and scientific results is the greatest factor in the improvement of quality, efficiency, or the development of new industries.

The work of testing and investigating the properties of structural materials was taken up and is carried on primarily for the needs of the Government in its structural work, but this information is just as necessary to the public in construction work, and every effort is made by the Bureau to make its findings in a form available to the public generally. In this, again, the Journal can really help, especially if its members will avail themselves of the information.

The work of the structural engineering and miscellaneous materials division includes the investigation, testing and preparation of specifications for these materials, such as the metals and their alloys, stone, cement, concrete, lime, the clay products, paints, oils, paper, textiles, rubber and other miscellaneous materials. Questions pertaining to the manufacture, specifications, testing, and use of the metals and their alloys have become so important that a metallurgical division has been formed of the experts engaged in these problems.

The engineering data resulting from investigations which the Bureau is conducting in reference to fireproofing of building columns, and partitions, should serve as the foundation upon which building codes must be constructed.

Some progress has been made recently in compiling the municipal building codes, both with a view to furnishing information to state and city building bureaus and to others interested, and to permit a comparative study of existing codes, to assist in planning a systematic program of investigations of the many important questions about which there are still great differences of opinion. This data will be available to the Institute's committee on Basic Building Code, whose coöperation will be welcomed.

Many inquiries are received annually from architects, engineers, contractors, and builders as to methods of waterproofing concrete, methods of construction to be employed in sea water, physical properties of concretes of various mixtures, the cause of staining of plaster walls and ceilings, methods of preventing the dusting of cement floors, suggestions for building code requirements, the physical properties of marbles, specifications for stucco, fire-resisting properties of structural materials, the corrosion of metal lath, and reinforcement of gypsum plasters.

From the general public requests are received for information on methods of mixing concrete, laying of concrete sidewalks, waterproofing basements, suitability of various materials for use in concrete, durability of composition magnesite floors, physical properties of stones, effect of frost action on concrete, suitability of concrete for oil and acid storage tanks, dampproofing brick and tile walls, dusting of concrete floors.

It is hoped that the acquaintances formed with architects, manufacturers, dealers, and consumers will result in mutual advantage to them and to the Bureau, and that they will feel more inclined to place their problems before the Bureau for solution. Thus the Bureau will be better able to understand their difficulties, and be of the fullest possible service to the people of this country.

—Rewritten from the current Report to the Secretary of Commerce, by SAMUEL W. STRATTON, Director

1A3 Other Governmental Departments

The U. S. Geological Survey and the Bureau of Mines will be referred to in Serial No. 2. The Forestry Service of the U. S. Department of Agriculture and other govern-

mental departments will be referred to in later serial numbers in connection with the industries with which they are most concerned.

1A4 American Society for Testing Materials

Affiliated with the International Association for Testing Materials.

Secretary-Treasurer: Edgar Marburg, University of Pennsylvania, Philadelphia.

Publications:

Proceedings, published annually, in two parts containing:

- (a) Reports of technical committees and Tentative Standards, published for one or two years for criticism before final action toward their adoption (of which there are now 30).
- (b) Technical papers and discussions.
- (c) Book of American Society for Testing Materials Standards, about eight hundred pages, published biennially in the even years and containing the standards adopted by the Society in their latest revised form (of which there are now 103).
- (d) A pamphlet annually, containing list of members, personnel of committees, and general information concerning the Society and the International Association. Circulars of information to members are also issued at irregular intervals averaging about one a month.
- (e) Standards, also published individually at 25 cents each; to members, 15 cents.

Each member receives the above publications except (e), by virtue of his membership. Current issues obtainable by non-members at (a) paper \$5; cloth \$5.50; (b) ditto; (c) cloth only \$7.50; (d) \$1.

Organized 1898 as American Section of the International Association of Testing Materials. Incorporated 1902 as American Society for Testing Materials, under which designation it maintains affiliated relations with the International Association.

Its purpose is the promotion of knowledge of the materials of engineering, and the standardization of specifications and methods of testing.

Membership may be held by individuals, firms, corporations, technical or scientific societies, companies, teaching faculties, and libraries. For information address the Secretary.

The work of the Society is done largely through its technical committees, which present reports and recommendations at the annual meeting, usually in June. There are now 36 technical committees with a total membership of 992.

On committees dealing with subjects having a commercial bearing, either an equal numeric balance is maintained between the representatives of consuming and producing interests, or the former are allowed to predominate with the acquiescence of the latter.

Standards: (From "Regulations Governing Technical Committees.")

"Proposed new standards or the proposed amendment of existing standards must originate in the particular committee within whose province such standards properly belong. No action affecting standards shall be taken by

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any technical committee except at meetings called for that purpose. Action at such meetings shall be subject to majority vote of those voting, and subsequently to majority of those voting on letter ballot of the entire committee. The results of each letter ballot as to the number of the affirmative votes, the number of negative votes, and the number of members not voting, shall be announced in the report of the committee to the Society. Dissenting members shall have the right to present minority reports, individually or jointly, at the annual meeting of the Society at which the majority report is presented.

"Any recommendations affecting standards must be transmitted to the Secretary-Treasurer of the Society at least eight weeks in advance of the date of the annual meeting, and copies of these recommendations, in printed form, must be mailed by the Secretary-Treasurer to every member of the Society not less than four weeks before the annual meeting, so that members may come to the meeting prepared to discuss such recommendations, and that members not intending to be present at the meeting may contribute discussions by letter.

"At this meeting amendments may be made by a two-thirds vote of those voting. The proposed new standards or the proposed amendments of existing standards, as presented or as amended, shall be printed, on a two-thirds vote of those voting, in the Yearbook under a section designated 'Tentative Standards,' on which written discussions addressed to the appropriate committee shall be invited. At the annual meeting in the next even year these proposed new standards or proposed amendments of existing standards shall be subject to amendment by a two-thirds vote of those voting, and to reference by a like vote to letter ballot of the Society. A two-thirds vote of those voting shall be required for adoption.

"The term 'Standards' shall be applied collectively to standard specifications, standard tests, standard methods, and standard definitions."

The various standards affecting materials or methods of building construction will be separately referred to under the especial material or industry affected. A pamphlet giving a complete list of all Standards may be had upon application to the Secretary.

In reference to the Standards of this Society THE COMMITTEE ON MATERIALS AND METHODS OF THE INSTITUTE calls attention to the following excerpt from the recent report of the Executive Committee, American Society for Testing Materials:

"The increasing use of the Standard Specifications of the Society in federal, state and municipal circles, apart from their extensive adoption in ordinary commercial channels, is significant of the confidence placed in the work of the Society and serves to emphasize the reciprocal obligation upon the Society to justify that confidence in connection with everything to which its name is attached. Purchases for the Panama Canal have been made largely under its standards, twenty-seven of the Standard Specifications of the Society being now in use by the purchasing department of the Canal. Again, nine of the Standard Specifications have been adopted—in some cases with slight modifications—in connection with the Boiler Code recently prepared by a committee of the American Society of Mechanical Engineers, which is expected to be adopted in many states by legal enactment."

THE COMMITTEE ON BASIC BUILDING CODE OF THE INSTITUTE calls attention to this excerpt:

"Similarly, in the current revision of the Building Code of the city of New York, seven Standards of the Society are referred to in some such form as the following:

"Except as may be otherwise prescribed by the rules of the Superintendent of Buildings . . . shall conform to the Standard Specifications of the American Society for Testing Materials. . . ."

1A5 The American Society of Civil Engineers (Reference later)

1A6 American Society of Mechanical Engineers (Reference later)

1A7 The American Institute of Mining Engineers

Organized 1871

Secretary: Bradley Stoughton, 29 West 39th Street, New York City.

Publications:

- (a) Transactions, three volumes annually, contain the proceedings of the Institute which constitute an important record of progress in research and practice in mining and metallurgy.
- (b) Monthly Bulletin contains professional papers, reports of proceedings, a forum for discussion and other matters of interest.
- (c) Papers and discussions printed in the Bulletins are also published as individual pamphlets.
- (d) Year Book containing a list of members and committees.

Members receive (a) and (b) free; to non-members the prices are (a) each volume, paper, \$5, in half morocco \$6; (b) \$12 per annum.

Technical committees are actively at work for the advancement and welfare of the profession and to promote discussion and stimulate the preparation of technical papers.

The Institute aims to promote the economic production of the useful minerals and metals, and the welfare of those employed in these industries.

1A8 American Institute of Architects

Organized 1857

Secretary: W. Stanley Parker, The Octagon, Washington, D. C.

Publications:

- (a) Constitution and By-laws, in which are set forth requirements for membership.
- (b) Circular of Advice Relative to Principles of Professional Practice and Canons of Ethics.
- (c) Schedule of Proper Minimum Charges.
- (d) Circular of Advice on Architectural Competitions.
- (e) Standard form of Architectural Program.

- (f) Circular as to Size and Character of Printed Matter Intended for Architects' Files.

All of the above are free on request.

- (g) Standard Documents, being Contract Forms prepared under careful study and joint agreement with national organizations interested in the building industry. Complete set, in cover, 15 cents, or obtainable from dealers generally.
- (h) Monograph on the Octagon. An illustrated history of this charming house. \$12.50.
- (i) Journal of the American Institute of Architects. Monthly, \$3.50 per annum. Foreign, \$5.

SERIAL NO. 1

- (k) The Annuary, containing a list of members and committees.
(l) The Proceedings, being the transactions of the Annual Convention (k) and (l), are free to members only. To others, \$5 each. For list of Chapters and officers, see Journal (j).

Its objects are to organize and unite in fellowship the architects of the United States of America, to combine their efforts so as to promote the esthetic, scientific, and practical efficiency of the profession, and to make the profession of ever-increasing use to Society.

1A9 American Railway Engineering

Secretary: E. H. Fritch, 900 S. Michigan Ave., Chicago, Ill.

Publications:

- (a) Proceedings; annually; contain complete committee reports, full discussion and special articles.
(b) Bulletin; ten issues annually; committee reports and monographs.
(c) Manual of the A.R.E.A. First Edition, 1905; 2nd, 1907. Supplements, September, 1906, September, 1907. Revised Edition, 1911. Supplements 1912, 1913, 1914. The current (1915) edition contains the action of the 1915 Convention and a comprehensive revision of the action of previous conventions. Included in the contents are:
(d) Principles of practice.
(e) Suggestions and recommendations.
(f) Specifications adopted (Standards).
(g) Standard form of contract and bond.

Members receive all of the above. Others may purchase them from the Secretary or book-dealers at: (a) paper \$6, cloth \$6.50, half morocco \$7; (b) per annum \$8; (c) paper \$4, cloth \$4.50, half morocco \$5.

The object of the Association is the advancement of knowledge pertaining to the scientific and economic location, construction, operation and maintenance of railways. What an important relation much of this has to the art and science of building construction will become

Standing and special committees report through the Board of Directors to each Annual Convention; the reports and action of the Convention are published in the Proceedings (l). Actions of the Board at meetings between Conventions and other matters of interest and information are published monthly in the Journal.

Standards: The only standards adopted are those referred to under publications as *e, f,* and *g.*

Association*

Organized March, 1899, under the laws of state of Illinois (not for profit)

evident from the references to the work of this Association under the various industries, as treated.

Adopted Specifications:

The Manual (c) includes only such conclusions relating to definitions, specifications and principles of practice as have been made the subject of a special study by a Standing or Special Committee and embodied in a Committee Report, published not less than thirty days prior to the annual convention, and submitted by the Committee to the annual convention, and which, after due consideration and discussion, shall have been voted on and formally adopted by the Association. Subjects which, in the opinion of the Board of Direction, should be reviewed by the American Railway Association, may be referred to that Association before being published in the Manual.

Matters adopted by the Association and subsequently published in the Manual shall be considered in the direction of good practice, but shall not be binding on the members.

*Formerly, American Railway Engineering and Maintenance of Way Association—name abbreviated in 1911.

1A10 Western Society of Engineers (Reference later)

1B Testing, Inspection and Research Facilities

Throughout the literature of materials and products, and of appliances and systems pertaining to buildings, there constantly recur the names of departments, bureaus, testing stations, laboratories, and universities, with tables, tests and analyses and references to labels, approvals, and lists of inspected materials.

This is indicative of a widespread interest and service involving activities which need to be better understood by the building public in order that their significance shall be more fully appreciated. It is also vitally necessary that a full understanding of the functioning of these activities and of the methods employed in the testing and inspection of materials prevail among architects, builders and all contractors.

Recognition of tests for the purposes of use intended and of those made by engineers or organizations whose findings are known to be generally acceptable to all concerned is a desideratum. The importance to be attached

to testing and checking up for continuity of quality and performance is obvious.

To quote from the National Electric Safety Code (1A2e):

"In order to avoid the necessity for a repetition of such examinations by different examiners, frequently with inadequate facilities for such work, and to avoid the confusion which would result from conflicting reports as to the suitability of devices examined for a given purpose, it is necessary that such examinations should be made under standard conditions, and the record made generally available through promulgation of organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories and service value determinations through field inspections, and whose findings are subject to appeal to departments of the Federal Government having equipment for such review."

Some governmental facilities and others of national scope and semi-public nature are:

1B1a Bureau of Standards, Department of Commerce, U. S. A.

Functions of the Bureau pertaining to building construction in general have been previously described.

In reference to testing, the following is taken from Circular No. 45, "The Testing of Materials," which contains full information and a schedule of the fees charged and may be had upon application to the Director of the Bureau:

"Tests of materials are made for the public where the Bureau is asked to act as referee or where an authoritative test is demanded by the nature of the case, or in other

cases where the Bureau is primarily interested in the test in connection with investigation. The right is reserved to make such use of the results of these tests as is deemed desirable. The Bureau will cooperate with investigators, manufacturers, testing laboratories, and others, not only in executing tests, but also on request, in furnishing any information at its disposal concerning materials or methods of testing."

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1B1b Watertown Arsenal, War Department, U. S. A.

Watertown, Mass.

Publications:

The results of all public tests are published in the annual report of the laboratory, entitled (a) "Tests of Metals," the first volume of which is dated 1881. When available, these volumes may be purchased at cost by applying to the "Superintendent of Documents, Government Printing Office, Washington, D. C."

This laboratory is officially designated as the "Testing Laboratory, Watertown Arsenal, Watertown, Mass."

The laboratory is equipped with two horizontal emery testing-machines, one of 800,000 pounds and the other 100,000 pounds capacity, both adapted for tensile or compressive tests, and with all necessary accessory apparatus, such as measuring instruments, extensometers, machines for determining hardness, testing cement briquettes, and similar work.

All classes of constructive materials are tested, such as iron and steel, in the form of test specimens or full-sized

members, cement in briquettes or concrete columns and cubes, brick, or stone.

Under the law any citizen of the United States may have tests made by defraying the cost.

Immediately upon receipt of application for test an estimate of the cost of the work will be furnished, and a sum equal to this estimate must be deposited before work for private parties can be begun.

An official report will be furnished covering each test. All data for private tests is considered confidential, and information concerning same will be furnished only to the party for whom the work is done or his order.

A list of all such tests, giving the name and address of the party for whom made, date of test, and kind of material is published in the annual report of the testing laboratory, entitled "Tests of Metals."

1B1c Office of Public Roads and Rural Engineering, Department of Agriculture, U. S. A.

Director: Logan Waller Page, Washington, D. C.

A laboratory is maintained wherein it has been the policy of this office to test, free of charge, for any citizen of the United States, samples of rock, gravel, sand, clay,

etc., provided they are submitted strictly in accordance with printed instructions which are furnished upon request. Such tests relate to the value of material for use in road-work and a report as to such value only is furnished.

1B2a Underwriters' Laboratories (See, also, 3A6)

Chartered by the state of Illinois, 1901.

President: William H. Merrill, 207 E. Ohio Street, Chicago.

(NOTE: For list of publications and further description of facilities and service see Industrial Section, page 141.)

This institution began its work some twenty years ago as an electrical testing station. Expansion has continued until now the Laboratories undertake to keep its service available wherever it may be effectively employed in the testing and inspection of materials and products having a bearing on the fire hazard or upon accident prevention.

Equipment for this work includes a large plant at Chicago, a branch testing station in New York City and branch offices for the operation of inspections at factories

and labeling of standard products in more than a hundred cities and towns in the United States and Canada, and in London, England.

Upon the conclusion of examinations and tests, the results thereof are bulletined to the various insurance organizations and companies subscribing to or coöperating with the Laboratories' work and a copy of the bulletin and the detailed report is furnished the applicant.

Underwriters' Laboratories was established by, and is maintained by, the National Board of Fire Underwriters for service, not profit.

For the work of the Laboratories, with reference to steel and concrete structural member and fire protection, see current activities under these respective headings.

1B2b Associated Factory Mutuals' Laboratories (See 3A7, and 3A8)

1B3a Educational Research Work

In addition to facilities offered through Governmental agencies and semi-public institutions such as the foregoing, important work is being done in many educational institutions of the country which maintain laboratories, conduct experiments and make tests of building materials. These, while primarily in connection with the work of the students, add annually to the understanding of materials used in building construction, their qualities, action, protection and proper use.

In many cases this work assumes proportions that are of value not only to the students and local communities but to a national development. Many of these institutions distribute bulletins, circulars, and reports contributing toward this end. Among these may be mentioned the following: (Many of these conduct this work only in connection with their instructional activities. Others will make tests on materials which involve investigation and research elements as distinguished from tests of a purely routine or commercial nature. In those from which we

have heard, thirty-four in all, where, either through one of the departments or by arrangement with members of the instructive staff, experiments or tests will be conducted for those desiring them, the institution is indicated thus *. In those marked † are located branches of the American Society of Mechanical Engineers where regular meetings are held.)

- † 1. Agricultural and Mechanical College of Texas College Station, Texas
- † 2. Arkansas, University of * Fayetteville, Ark.
- † 3. Armour Institute of Technology* Chicago, Ill.
- † 4. Bucknell College Lewisburg, Pa.
- † 5. California, University of Berkeley, Cal.
- † 6. Carnegie Institute of Technology Pittsburgh, Pa.
- † 7. Case School of Applied Science Cleveland, Ohio
- † 8. Cincinnati, University of Cincinnati, Ohio
- † 9. Colo. State Agricultural College Fort Collins, Colo.
- † 10. Colorado, University of* Boulder, Colo.
- † 11. Columbia University New York, N. Y.
- † 12. Cornell University* Ithaca, N. Y.

SERIAL NO. 1

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| <ul style="list-style-type: none"> 13. Dartmouth College Hanover, N. H. †14. Georgia School of Technology Atlanta, Ga. †15. Illinois, University of Urbana, Ill. (See 3C2) †16. Iowa, State University of Iowa City, Iowa. †17. Kansas State Agricultural College Manhattan, Kan. †18. Kansas, University of Lawrence, Kan. †19. Kentucky, State University of Lexington, Ky. 20. Lafayette College Easton, Pa. †21. Lehigh University South Bethlehem, Pa. †22. Leland Stanford, Jr., University Stanford University, Cal. †23. Lewis Institute Chicago, Ill. †24. Louisiana State University* Baton Rouge, La. †25. Maine, University of* Orono, Maine †26. Massachusetts Institute of Technology* Boston, Mass. †27. Michigan, University of Ann Arbor, Mich. †28. Minnesota, University of* Minneapolis, Minn. †29. Missouri, University of Columbia, Mo. †30. Nebraska, University of Lincoln, Neb. †31. New York University* New York, N. Y. | <ul style="list-style-type: none"> †32. Ohio State University* Columbus, Ohio 33. Princeton College* Princeton, N. J. †34. Pennsylvania State College State College, Pa. 35. Pennsylvania, University of Philadelphia, Pa. †36. Polytechnic Institute of Brooklyn Brooklyn, N. Y. †37. Purdue University* Lafayette, Ind. †38. Rensselaer Polytechnic Institute Troy, N. Y. †39. Rose Polytechnic Institute Terre Haute, Ind. †40. Stevens Institute of Technology* Hoboken, N. J. †41. Syracuse University* Syracuse, N. Y. 42. Texas, University of* Austin, Tex. †43. Throop College of Technology* Pasadena, Cal. 44. Tulane University New Orleans, La. †45. Virginia Polytechnic Institute Blacksburg, Va. †46. Washington State University Seattle, Wash. †47. Washington University* St. Louis, Mo. †48. Wisconsin, University of* Madison, Wis. †49. Worcester Polytechnic Institute* Worcester, Mass. †50. Yale University New Haven, Conn. 51. Oklahoma A. & M. College* Stillwater, Okla. |
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1B4 Testing Laboratories and Inspection Bureaus

For the practical business assistance of architects, engineers, and others in conducting tests and analyses of earth-pressure, sand, cement, and building materials generally, and in inspecting the manufacture and erection of steel and other structural members, there exists a number of testing laboratories and engineering concerns of national scope. Many include in their management or on their staff

prominent members of several of the societies previously mentioned.

For general description of laboratory and inspection service of Underwriters' Laboratories, see Industrial Section, page 141.

For detailed description of engineering, laboratory, and inspection service of Robert W. Hunt & Company, see Industrial Section, pages 142, 143, 144.

In the case of each industry, after describing the governmental departments and professional, technical, commercial and other associations interested, the order of presentation to be followed, as nearly as possible, will be,

*Introductory Remarks.
Information Obtainable.
Practice Recommended.*

*Standards Adopted, or
Progress Reported.
Current Activities.*

1C Foundational Requirements, Concrete Piling and Steel Piling

(Other footings and foundations: Stone, Serial No. 2; Brick, Serial No. 3; Wood Piling, Serial No. 5.)

Problems connected with soil conditions are encountered throughout the country. Pending actual investigation of the site, an acquaintance with the source of data concerning conditions likely to be found, the require-

ments of various cities as to floor loads and bearings allowed, methods of overcoming obstacles similar in nature, the character of engineering or constructional assistance to be obtained, and other information tending to simplify investigation and facilitate subsequent treatment, should prove helpful.

1C1 Information Obtainable

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| <ul style="list-style-type: none"> (a) The Pennsylvania State College Engineering Experiment Station (1B3a, 34). Bulletin, June, 1913. "Experiments on the Distribution of Vertical Pressure in Earth," by R. B. Fehr and C. R. Thomas. (b) A.S.C.E. (1A5), Transactions, Vol. LIII, p. 272. "Lateral Earth-Pressures and Related Phenomena," E. P. Goodrich. (c) Ditto, Vol. LXX, p. 352, "Pressure, Resistance and Stability of Earth," J. C. Meems. (d) Ditto, Vol. LXXI, p. 350, "Earth and Retaining Walls," G. H. Darwin. (e) "Allowable Pressure on Deep Foundations," E. L. Corthell. (f) "A Practical Treatise on Sub-Aqueous Foundations," C. E. Fower. (g) "Foundations of Bridges and Buildings," Jacoby and Davis. | <ul style="list-style-type: none"> (h) "Masonry Construction," Ira O. Baker. (j) "Foundations," M. A. Howe. (k) "Masonry," M. A. Howe. (l) The U. S. Geological Survey has published about four hundred reports (2A14) on various phases of water-supply and conditions likely to be met with in excavating and similar work. Request should be made for information concerning a specific section of the country. (m) In "Journal of the Western Society of Engineers" (1A10) for June, 1914, will be found "Topography of the Red Rock under Chicago," by Roderick Peattie, including diagrams and followed by discussions participated in by several architects |
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1C2 Other References

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| <ul style="list-style-type: none"> (a) "Kidder's Pocket Book," pp. 129-229, 978-982, 1450. (b) "American C. E. Pocket Book," Mansfield Merriman. (c) "Handbook of Cost Data for Contractors and Engineers," H. B. Gillette. (d) "Building Superintendence and Construction," F. E. Kidder. (e) "Carnegie Pocket Companion, 1916," pp. 104, 188, 258-262, 348-351. | <ul style="list-style-type: none"> (f) "Jones & Laughlin Manual, 1916," pp. 82-89, 218-222, 243 284-290. (g) "Concrete Pile Standards," Hunley Abbott, Associate Member A.S. of C.E. (h) For illustrations and descriptions of Concrete Piles, see Industrial Section, page 200, Raymond Concrete Pile Co. |
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1C3 Practice Recommended

- (a) By the National Board of Fire Underwriters (Serial No. 3), "Building Code Recommended by the N. B. of F. U.," 1915.
"Excavations, Foundations and Footings," pp. 25-32.
"Bearing Capacity of Soils," p. 28.
"Concrete Piles," pp. 32-34.

- (b) By, ditto, "Dwelling Houses, A Code of Suggestions for Construction and Fire Protection," 1916.
"Wooden Piling Standards" (adopted specifications), A.R.E.A. (1A9f), will be referred to in Serial No. 5, under "Piling, Piers and Bulkheads."

1C4 Current Activities

(a) Special Committee American Society of Civil Engineers (1A5). To codify present practice on the bearing value of soils for foundations. Robert A. Cummings, Chairman.

(b) An investigation of the resisting power of earths is being conducted by the Bureau of Standards, U. S. A., in coöperation with a committee of the American Society of Civil Engineers, and a large number of tests have already been made to determine the best means of testing earths under standard conditions. A study of the data thus far obtained has shown the need of some modification of apparatus, and this has been effected with good results. The general laws of earths subject to stress and strain have already been

definitely formulated in mathematical physics, but to obtain determinate solutions of the equations for application to engineering practice, it is necessary to know the elastic coefficients of actual earths. In the experimentation being conducted, the endeavor is made to supply these coefficients and their range of possible variation to a closer degree of precision than has been obtained heretofore. A number of experiments have also been carried out with good results to determine the laws of variation of frictional coefficients in relation to diameter and perimeter of piles and foundations as preliminary to further tests on a larger scale. (Report 1916, Bureau of Standards, 1A2a.)

1D Waterproofing and Damp-proofing

This subject, aside from its relation to engineering problems, is important in the construction of buildings, both above ground and underground. Investigation and experimentation is taking place in Governmental departments, educational institutions and in various laboratories including those maintained by some of the largest manufacturing interests in the country. Practical working tests are being conducted by professional and technical associations, and out of all these activities there will evolve a

clearer understanding of when, where and how results may be accomplished in the retention or exclusion of water or other liquids and in lessening the absorptive qualities of those materials enclosing or forming a part of structures.

Under this heading reference will also be made to those forms of construction which are intended to retain or repel water or control it against damage to contents of buildings or other objects.

See, also, "Bituminous Materials," 11C2, and "Treatments and Coatings," 12C.

1D1 Information Obtainable

- (a) American Society of Civil Engineers (1A5); "Proceedings" from 1872 to 1906; 24 references given in 1D1r.
(b) Ohio State University (1B3a32); 1901 and 1903; "Tests to Determine Causes and Remedies for the Permeability of Cement Mortar."
(c) Dartmouth College, Hanover, N. H. (1B3a13); Bulletin Thayer School of Civil Engineering; 1902; "The Permeability of Concrete under High Water Pressures," J. B. McIntire and A. L. Pure.
(d) National Association of Cement Users and American Concrete Institute (1E1); "Proceedings" from 1905 to 1912; 14 references given in 1D1r.
(e) Iowa State College Engineering Experiment Station (1B3a16), Vol. IV, Bulletin No. 3, 1908; "Experiments on Impermeability and Waterproofing of Cement Blocks, Etc.," B. R. Smith and H. L. Christian, F. E. Cave and G. H. Mack, and W. A. Burton.
(f) A.S.T.M. (1A4), Vol. VIII, p. 500, 1908; "Permeability Tests of Concrete with the Addition of Hydrated Lime," Sanford E. Thompson.
(g) American Railway Bridge and Building Association, Vol. XVIII, p. 46, 1908; "Report of Committee on Waterproofing of Concrete-covered Steel Floors of Bridges."
(h) University of Illinois (1B3a15); The Technography, No. 23; 1908, 1909; "Making Concrete Waterproof Tests of Alumand Soap Waterproofing under the Direction of Ira O. Baker," B. L. Bowling and C. G. Derrick.
(i) Iowa State College Engineering Experiment Station (1B3a16), Vol. IV, Bulletin No. 4, 1909; "Experiments on Permeability and

- Waterproofing Concrete, Etc.," R. R. Strothers and Platt Wilson, O. L. Huffman and E. S. Fowler, Royce Heath, and others.
(j) University of Wisconsin (1B3a48), Vol. VI, Bulletin No. 1, 1909; "Tests on the Permeability of Concrete," Francis Michael McCullough.
(k) A.S.T.M. (1A4), 1909, 1911, 1913; "Reports of the Committee on Waterproofing Materials."
(l) A.S.T.M. (1A4), Vol. X, p. 351, 1910; "The Effect of Sodium Silicate Mixed with or Applied to Concrete," Albert Moyer.
(m) American Railway Engineering Association (1A9a), 1910, 1911, 1912, 1914; "Reports of Committee on Masonry."
(n) U. S. Bureau of Standards (1A2c); Technologic Paper No. 3, 1912; "Tests of the Absorptive and Permeable Properties of Portland Cement Mortars and Concretes, Together with Tests of Damp-proofing and Waterproofing Compounds and Materials," Rudolph J. Wig and P. H. Bates.
(o) A.S.T.M. (1A4), Vol. XIII, 955, 1913; "Coal Tar and Asphalt Products for Waterproofing," Samuel T. Wagner.
(p) U. S. Department of Agriculture (1B1c), Bulletin No. 230, 1915; "Oil-Mixed Portland Cement Concrete," Logan Waller Page.
(q) U. S. Reclamation Record (9D3b), Vol. VI, No. 4, 1915; "Waterproofing Concrete Surfaces," J. L. Lytel.
(r) International Engineering Conference; paper presented at San Francisco, Cal., 1915; "Waterproof Concrete," Richard L. Humphrey, Philadelphia, Pa. (Same contains a complete bibliography of waterproofing and concreting to which the Editor is indebted for the references herein given as of especial interest to building constructors.)

1D2 Other References (See, also, some of those under Hydrated Lime, 2B6)

- (a) "Kidder's Pocket Book," pp. 1629-1637.
(b) "Modern Methods of Waterproofing," Myron H. Lewis.
(c) "Asphalt," Clifford Richardson.
(d) "The Waterproofing of Fabrics," S. Mierzinski.
(e) "Dampness in Buildings," A. W. Keim.
(f) "Building Superintendence and Construction," Frank E. Kidder.
(g) "Merriman's Pocket Book."

- (h) For information pertaining to "Protective Paints," "Damp-Resisting Paints," "Damp-Proof Coatings," and Powder to be Mixed with Portland Cement," see pages in Industrial Section, as follows:
1. Samuel Cabot, Inc., page 190.
2. The Solvay Process Company, Semet-Solvay Company, page 192.
3. Toch Brothers, Toch Products, page 193.

SERIAL NO. 1

1D4 Practice Recommended

- (a) By, Inspection Dept. Asso. Factory Mutual F. I. Co.'s (Serial No. 3), Feb., 1915; "Watertight Floors of Mill Construction."
(b) By, N.B. of F.U. (Serial No. 3) "Building Code Recommended by the N.B. of F.U.," 1915, "Waterproofing of Floors," pp. 126, 128, 129.

- (c) By A.R.E.A. (1A9e), 1915, Committee on Masonry, "Waterproofing of Masonry."
(d) See, also, Report of Committee under 1D1g.

1D5 Progress Reported (See, also, reference to later report under 11C2)

"Committee D8 of the A.S.T.M., since its organization in 1905, has, through laboratory tests and experiments, together with examinations of work during construction and after completion, as well as the study of literature on the subject, sought to secure sufficient information to enable it to formulate definite methods for securing waterproof concrete structures. The work of the Committee was complicated by reason of the fact that there seemed to be so little concordance between results of tests obtained under laboratory conditions and in the

field and that it was necessary to extend its investigations over a period of years in order to determine the permanency of the action noted. The Committee reported that while it had not been able to arrive at sufficiently definite conclusions to enable it to formulate specifications for the making of concrete structures waterproof or for materials to be used in such work, it had reached certain general conclusions which might be of assistance to the constructor in securing the desired result of impermeable concrete."—From "Kidder's Handbook," 1916, p. 1630.

1D6 Current Activities

Investigation of Integral Waterproofing Compounds.

(a) During the year a coöperating committee was organized, composed of representatives from Government offices, engineering societies, and the various industries, including all known manufacturers of waterproofing compounds. This committee coöperated in planning a series of field experiments, which contemplates the construction of concrete tanks by contract, both with and without waterproofing compounds. These tanks are to be located below grade near the Potomac River and subject to tidal water. A questionnaire was also prepared and submitted to architects, contractors, and engineers, to gather information on the present usage of these materials. Results of this investigation should be available during the ensuing year. (1916 Report, Bureau of Standards, 1A2a.)

Bituminous Materials.

(b) Definite methods of tests and specifications have been developed for coal-tar, waterproofing, and roofing pitches, to replace the loose and indefinite requirements which have been more or less in use in the Government service. Methods and specifications are being developed for asphaltic materials. Information is being obtained to insure satisfactory felts and papers for saturation with asphalt and tar products for waterproofing and roofing purposes. Modification of specifications for these latter materials may become necessary, since shortage of rag stock has increased the use of wood-pulp, jute, and manila fiber. (1916 Report, Bureau of Standards, 1A2a.)

(c) The use of lime will be referred to in Serial No. 2, February. (See especially 2B10 e and f.)

1E Cement and Concrete

The manufacture of American Portland cement first secured recognition at the Centennial Exposition in Philadelphia, in 1876, when David S. Saylor exhibited Portland cement made at Coplay, Pa. The first recorded statistics of this industry were those issued by the U. S. Geological Survey for 1880, during which year the production reached 42,000 barrels; in the preceding ten years the amount produced amounted to 82,000 barrels. Since 1880 the production has steadily increased and will probably exceed 90,000,000 barrels for the year 1916. At the beginning of the manufacture of Portland cement in this country, practically all that was used was imported; the earliest statistics of the Geological Survey show an importation of 92,000 barrels in 1878, which steadily increased reaching a maximum of about 3,000,000 barrels in 1895, since which time it has decreased to 42,218 barrels in 1915. This has resulted from the improvement in the process of manufacture in this country which has decreased the cost and increased the quality until today American Portland cement is unexcelled. The American manufacturer is successfully competing in the world's markets; and there

was exported in 1915 over 2,500,000 barrels. The preceding figures are taken from the annual reports of the statistics of the cement industry compiled and published by the U. S. Geological Survey.

The following has just been received from U. S. Geological Survey as of date January 1, 1917. "Another mineral product which furnishes an index of business conditions is cement, the 1916 production of which is estimated to be 5,000,000 barrels in excess of the output of the previous year, while the shipments were even greater, aggregating 94,500,000 barrels, with the outlook reported as good for the new year.

In addition to the governmental departments and other organizations previously mentioned which have taken important parts in developing standard specifications and tests for the manufacture and use of cement the following bodies working specifically in this field have coöperated in the improvement of this product and in bringing about a better understanding of the varied uses of cement and concrete.

1E1 American Concrete Institute

*Secretary.** Harold D. Hynds, 30 Broad Street, New York City.

Publications:

- (a) Journal, containing the Proceedings of Annual Conventions including reports of committees and also the following:
(b) Proposed Standard Specifications.
(c) Recommended Practice.
(d) Standard Specifications Adopted.

*Succeeded by H. B. Alvord, 27 School Street, Boston.

The following is also issued separately as an authorized reprint from the copyrighted Journal:

- (e) Standard Specifications.
Members receive (a) which may be purchased by others, cloth bound, for \$10.50; paper, \$10.

Founded in 1905 and incorporated in 1906 as National Association of Cement Users. Charter amended on July 2, 1913, and name changed to American Concrete Institute.

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Its purpose is to increase and disseminate knowledge in regard to the use of cement, concrete and allied products; to conduct research into their properties and uses; and to formulate recommended practice and standard specifications. Its object is purely educational.

Any person engaged in the construction or maintenance of work in which cement is used, or qualified by business relations or practical experience to cooperate in the purposes of the Institute, or engaged in the manufacture or sale of machinery or supplies for cement users, or a man who has attained eminence in the field of engineering, architecture or applied science, is eligible for membership.

1E2 Portland Cement Association

General Manager: J. P. Beck,* 111 West Washington Street, Chicago.

Organized as Association of Portland Cement Manufacturers in 1902. Name changed in 1904 to Association of American Portland Cement Manufacturers and in 1916, to Portland Cement Association. Headquarters moved from Philadelphia to Chicago in December, 1915.

Membership is voluntary and comprises about 93 per cent of the Portland cement producing capacity of the United States.

The Association employs a large number of engineers, architects and other specialists for the purpose of exploiting old and developing new uses for Portland cement. Considerable effort is expended in an endeavor to improve the quality of concrete work, both through advice as to proper specifications and actual supervision of work.

Employees of the Association and of member companies actively participate in the work of a large number

*Deceased. Succeeded by H. E. Hilts.

1E3 Cement Products Exhibition Company

Secretary: Blaine S. Smith, 210 S. La Salle Street, Chicago, Ill.

This company was organized for the purpose of holding national exhibitions to place before the people annu-

Standards: (See [d]). Sectional committees submit reports before Annual Conventions.

Proposed Recommended Practice and Specifications to be submitted to the Institute must be mailed to the members at least thirty days prior to Annual Convention, and as there amended and approved, passed to letter ballot, which shall be canvassed within sixty days thereafter, such Recommended Practice and Specifications shall be considered adopted unless at least 10 per cent of the total membership shall vote in the negative.

The standards adopted are referred to later under their special headings.

of committees of engineering and other societies whose work directly or indirectly involves the testing and use of cement and concrete.

The Association, on September 1, 1916, entered into an agreement with Lewis Institute of Chicago for the operation of the Structural Materials Research Laboratory. This is an endowed institution with an attendance of 3,500 students and the purpose of this Laboratory is twofold: To carry out research work in the properties of concrete and concrete materials for the information of all users; and to give instruction to the students of this institution on the properties and uses of concrete.

Publications:

In connection with its work of investigation and promotion to increase the effective uses and output of cement, the Association issues (a) books, (b) bulletins and (c) circulars looking toward standardized processes. These are distributed without charge unless otherwise noted.

ally a record of the progress and achievements in the manufacture and use of cement and concrete. The ninth annual cement show will be given in Chicago from February 7 to 15, 1917.

1E4 Information Obtainable

The following are selected from sixty publications of the U. S. Geological Survey (2A1) as giving the most comprehensive development of the industry in general, the remaining publications referring chiefly to special districts. Those without prices affixed are free upon application to the Director; those priced may be purchased from the Superintendent of Documents, Government Office, Washington; those marked "Ex." are exhausted.

- (a) "The Materials and Manufacture of Portland Cement," 1903, E. C. Eckel.
- (b) "Cement Materials and Cement Industries of the U. S.," 1905, E. C. Eckel, Bulletin 243, 395 pp. 65 cents.
- (c) "The American Cement Industry," 1905, E. C. Eckel, Bulletin 260. Ex.
- (d) "Portland Cement Mortars and Their Constituent Materials; Results of Tests 1905 to 1907," R. L. Humphrey, Bulletin 331, 130 pp. 25 cents.
- (e) "The Effects of the San Francisco Earthquake and Fire on Various Structures and Structural Materials," 1907, R. L. Humphrey, Bulletin 324, pp. 14-61. 50 cts.
- (f) "The Effect of the San Francisco Earthquake on Buildings, Engineering Structures and Structural Materials," 1907, J. S. Sewell, Bulletin 324, pp. 62-130. 50 cents.
- (g) "The Strength of Concrete Beams, Results of Tests Made at the Structural Materials Testing Laboratory," 1908, R. L. Humphrey, Bulletin 344, 59 pp. 10 cents.
- (h) "Mineral Resources of the United States" (2A1. Part 2) for 1909 and for each subsequent year up to 1915. Chapters on cement, by E. F. Burchard. 75 cts. each bound volume.

- (i) "Portland Cement Materials of the United States," with contributions by E. F. Burchard and others, 1913, Bulletin 522, 401 pp.

Other governmental contributions are:

- (k) Bureau of Standards (1A2c), 1911, "The Strength of Reinforced Concrete Beams, Results of Tests of 333 Beams," by Richard L. Humphrey and Louis H. Losse.
- (l) Ditto, No. 12, 1912, "Action of the Salts in Alkali Water and Sea Water on Cements," by P. H. Bates, A. J. Phillips and R. J. Wig.
- (m) Ditto, No. 58, "Strength and Other Properties of Concrete as Affected by Materials and Methods of Preparation," by R. J. Wig, S. M. Williams and E. R. Gates.
- (n) Ditto (1A2c), "Compressive Strength of Portland Cement Mortars and Concretes."
- (o) U. S. Department of Agriculture, Farmers Bulletin No. 403, 1915; "The Construction of Concrete Fence Posts."
- (p) U. S. Department of Agriculture, Farmers Bulletin No. 461, 1911; "The Use of Concrete on the Farm."
- (q) U. S. Department of Agriculture, Farmers Bulletin No. 481 1912; "Concrete Construction on the Live Stock Farm."

In addition to which are the following:

- (r) Inspection Dept., Associated Factory Mutuals Fire Insurance Companies (Serial No. 3), "Concrete Storehouse of Naumkeag Steam Cotton Co., which Successfully Withstood the Salem Conflagration," No. 37, 1914.
- (s) American Concrete Institute (1E1) August, 1915. Report of the Committee on Edison Fire.

During the Louisiana Purchase Exposition, at St. Louis, in 1904, an investigation of the constituent materials of

Portland cement mortars and concretes was inaugurated; this was continued on a more extensive scale in the Structural Materials Testing Laboratories of the U. S. Geological Survey at St. Louis and Pittsburgh, and the results of 25,000 of these tests were published in Bulletin No. 331 of the Survey (1E4d). The Survey extended the work and in coöperation with the state geologists and others has continued the investigation, collecting for test samples of mine tailings, sands, gravels, crushed slag, and stone to determine their value as aggregate for concrete.

With the transfer of this work in 1910, the Bureau of Standards has joined in this coöperation, and the results of the investigations, some of which are being published in state reports, will be published by the Bureau as they accumulate.

The Bureau has published the completed study of 20,000 tests of Portland cement mortars and concretes from the many investigations, made by the Structural Materials Testing Laboratories of the Geological Survey and those by the Bureau of Standards (1E4m). The results show that several of the generally accepted methods for

proportioning concrete mixtures are incorrect and that certain precautions are necessary in the fabrication of concrete to insure a product of known quality. The effect of different exposures while hardening, the effect of aging, and the effect of variation in the quantity of cement used, are discussed.

The relative value of various aggregates is shown, such as gravels, limestones, granites, trap rocks, cinders, sands, and stone screenings, also the relative value of round- and sharp-grained sands. Proper methods for testing and selecting aggregates are also suggested.

Other references to cement and concrete, too numerous to mention specifically, will be found in the Proceedings of the A.S.T.M. (1A4b), of the A.S.C.E. (1A5), of the Western Society of Civil Engineers (1A10), in the Journal of the A.C.I. (1E1a), and in other volumes and in the many monthly publications and other periodicals in which the cement and allied industries are featured.

For the "Durability of Concrete in Sea Water" and Bibliography see "Current Comments" at end of Serial No. 3.

For the use of Hydrated Lime in cement, see 2B6, 2B8, 2B10e, and f. For Cement and Concrete in Buildings, see "Reports on Buildings under Fire" (3E1) and "Buildings and Structures in General" (4B). For many other references of interest see "Plastic Materials and Products" (11C and 11C1; also, 11D5 and 11D6).

1E5 Other References

- (a) "Popular Handbook for Cement and Concrete Users," Myron H. Lewis and Albert H. Chandler.
- (b) "Inspection of Concrete Construction," Jerome Cochran.
- (c) "Concrete Construction, Methods and Costs," H. P. Gillette and Charles S. Hill.
- (d) "Engineers' Pocket Book of Reinforced Concrete," E. Lee Heidenreich.
- (e) "Building Superintendence and Construction," Frank E. Kidder.
- (f) "Kidder's Pocket Book," pp. 235-240, 282-288, 816-818, 824-894, 905, 911-997.
- (g) "Carnegie Pocket Companion, 1916," pp. 51-54, 118-129, 327-333, 365-370.
- (h) "Jones & Laughlin, Manual, 1916," pp. 80, 81, 132, 285, 289, 292.

1E6 Practice Recommended

By American Railway Engineering Association (1A9f), 1916:

- (a) "Specifications for Plain and Reinforced Concrete and Steel Reinforcement."
- (b) "Designs of Reinforced Concrete Structures."
- (c) "Monolithic Construction."
- (d) "Waterproofing of Masonry."
- (e) "Methods of Depositing Concrete under Water."
- (f) "Methods of Repairing Defective or Worn Surfaces of Concrete."

By National Fire Protection Association (Serial No. 3).

- (g) "Specifications for Construction of a Standard Building," Report of Committee on Fire Resistive Construction, 1913.

By National Board of Fire Underwriters (Serial No. 3).

- (h) "Building Code Recommended by the N.B. of F.U.," Fourth Edition, 1915.
- (j) "Dwelling Houses—A Code of Suggestion for Construction and Fire Protection," First Edition, 1916.

1E7 Standards Adopted

- (a) *Standard Specifications and Tests for Portland Cement, A.S.T.M. (1A4). Serial Designation C9-17.*

The undersigned represented the American Institute of Architects at the last three annual meetings of the American Society for Testing Materials. The Institute was appointed a member of that Society's Standing Committee on Cement, and of the latter's Subcommittee on General Clauses.

The consideration of specifications for cement dates as far back as 1885, when a Special Committee of the American Society of Civil Engineers presented a report on "Uniform System of Tests of Cement;" the Committee of the American Society for Testing Materials on Standard Specifications for Cement did not come into being until 1902. This Committee in 1903 adopted as the basis for its work the methods of tests recommended by the Special Committee on Uniform Tests of Cement of the American Society of Civil Engineers. In order to obtain

- (j) "Standard Specifications," J. C. Ostrup.
- (k) "Design of Walls, Bins and Grain Elevators," M. S. Ketchum.
- (m) "Handbook of Cost Data for Contractors and Engineers," H. P. Gillette.
- (n) "Factories and Warehouses of Concrete," P.C.A. (1E2a).
- (o) "The Concrete House and Its Construction," P.C.A. (1E2a).
- (p) For information pertaining to the manufacture and use of cement and to engineering services in connection with reinforced concrete and inspection and testing of cement and of reinforcing steel, see pages in the Industrial Section as follows:
 1. Atlas Portland Cement Company, pp. 198, 199.
 2. Corrugated Bar Company, p. 197.
 3. R. W. Hunt & Company, pp. 142, 143, 144.

By American Concrete Institute. (1E1c)

- (k) "Standard Recommended Practice for the Use of Reinforced Concrete," 21 pp. (No. 7.)
- (l) "Standard Recommended Practice for Concrete Drain Tile," 3 pp. (No. 9.)
- (m) "Standard Recommended Practice for Concrete Architectural Stone, Building Block and Brick," 4 pp. (No. 10.)

By American Society for Testing Materials (1A4a).

- (n) "Form of Specifications for Certain Commercial Grades of Broken Stone."

- (o) In addition to the foregoing there are many excellent publications of the Portland Cement Association (1E2) which are practical recommendations, many with diagrams, for the use of cement and concrete.

data to aid in drafting specifications, it also arranged a series of tests by some thirty prominent laboratories. The results of these tests were collated, and a specification was recommended by the Committee and adopted by the Society in 1904.

The American Railway Engineering and Maintenance of Way Association, upon the recommendations of its Committee on Masonry, adopted this specification in 1905, and the revisions in 1908 and 1909.

In 1912, a Board of Engineers was appointed to revise the specifications for cement of the U. S. Army. This Board later coöperated with a U. S. Departmental Conference in preparing a specification which was adopted by the U. S. Government by Executive Order, April 30, 1912. The American Society of Civil Engineers accepted the final report of its Special Committee on Uniform Tests of Cement, January 17, 1912. The American Society for Testing Materials adopted the revisions recommended by its Committee, August 16, 1912.

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The effort to reconcile the differences in these recommendations led to the organization on October 24, 1912, of the Joint Conference on Uniform Methods of Tests and Standard Specifications for Cement, consisting of three representatives each appointed by the Board of Direction of the American Society of Civil Engineers, by the Committee on Standard Specifications for Cement of the American Society for Testing Materials, and by the U. S. Departmental Committee. After several years' work, this Conference reported recommended American Specifications and Methods of Tests for Portland Cement; these were considered by the several organizations of which the conference was composed, further modifications made and specifications and Methods of Tests for Portland Cement to become effective January 1, 1917, were adopted by the American Society for Testing Materials, September 1, 1916; they were approved by the U. S. Departmental Conference, December 7, 1916, and were reported favorably by the representatives of the Board of Direction of the American Society of Civil Engineers, December 24, 1916.

There is now a single American specification and methods of test for Portland cement, with its attending advantages to the cement industry and to architects, engineers and others. With this standard now available all architects should encourage its use in every possible way and refer to it on all occasions relating to the use of Portland cement.—THOMAS NOLAN, *Chairman Institute Committee on Materials and Methods*.

These Standards will be found printed and illustrated in Book of A.S.T.M., 1916 (1A4c); also separately (1A4e); also published as a separate booklet for general distribution by the Portland Cement Association (1E2).

(b) Joint Committee Report: Concrete and Reinforced Concrete.

The final report of the Joint Committee on Concrete and Reinforced Concrete marks the completion of a highly important step in the standardization of the practice in the use of this very essential material of construction.

This work was undertaken more than twelve years ago when the Joint Committee was organized at Atlantic City, N. J., June 17, 1904, at the meeting of the several special committees representing the American Society of Civil Engineers, the American Society of Testing Materials and the American Railway Engineering and Maintenance of Way Association, initiative having been taken by the American Society of Civil Engineers at its annual convention at Asheville, N. C., June 11, 1903, by the adoption of the following resolution:

"It is the sense of this meeting that a special committee be appointed to take up the question of concrete and steel-concrete and that such committee coöperate with the American Society for Testing Materials and the American Railway Engineering and Maintenance of Way Association." There were subsequently added to this Committee, which now has a membership of twenty-eight, special

committees representing the Association of American Portland Cement Manufacturers and the American Concrete Institute. Subcommittees were appointed to consider the various divisions of the subject, and their reports were considered at the thirty meetings attended by a majority of its members."

Progress reports were made in 1909 and 1912 and after consideration of the criticisms of these reports and study of new experimental data, the Joint Committee revised, to some extent, its previous recommendations on subjects not previously touched upon and adopted its final report July 1, 1916.

The recommendations of this Committee have a far-reaching influence; they form the basis of progressive municipal and state building regulations, the specifications and recommended practice of the American Railway Engineering Association, the Standard Building Regulations of the American Concrete Institute and similar standards.

The report is of inestimable value in standardizing the art, and every architect should have a copy for ready reference in designing structures of concrete and reinforced concrete.

The Joint Committee has performed a meritorious service, with care and thoroughness, and has more than justified its existence.

This pioneer work in the standardization of the art of concrete and reinforced concrete construction could only have been so satisfactorily performed by a committee thus constituted.—RICHARD L. HUMPHREY, *Secretary, Joint Committee*.

See note under "Current Comments" at end of Serial No. 3, as to available copies which will be furnished upon request.

EDITOR'S NOTE.—The inconsistencies in the requirements of varying building codes and ordinances in cities throughout the United States has frequently been pointed out by architects and engineers, and will be referred to under later serial numbers in the hope that the Structural Service Department may be of assistance in effecting through the co-operation of the municipalities and states uniform standards of practice in the use of concrete.

Other standards with reference to concrete and reinforced concrete are

- (c) A.S.T.M. (1A4c and e) "For Billet-Steel Concrete Reinforcement Bars," Serial Designation A15-14.
- (d) Ditto, "For Rail-Steel Concrete Reinforcement Bars," Serial Designation A16-14.
- American Concrete Institute (1E1c and e.)
- (e) "Standard Building Regulations for the Use of Reinforced Concrete." 13 pp. (No. 4.)
- (f) "Standard Specifications for Scrubbed Concrete Surfaces." 3 pp. (No. 8.)
- (g) "Standard Specifications for Concrete Architectural Stone, Building Block and Brick." 3 pp. (No. 11.)
- (h) "Standard Building Regulations for the Use of Concrete Architectural Stone, Building Block and Brick." 3 pp. (No. 12.)
- (j) "Standard Specifications for Portland Cement Stucco on Metal Lath, Brick, Tile or Concrete Block" 9 pp. (No. 15.)
(For other recommended practice as to stucco, see page xi.)
- (k) "Standard Methods for the Measurement of Concrete Work." 7 pp. (No. 16.)
(See also "Standards" under 1E9.)

1E8 Current Activities

(a) *Investigations and Tests on Concrete and Other Columns.* Being conducted by the U. S. Bureau of Standards in coöperation with the Underwriters Laboratories and the

Factory Mutuals Laboratories will be referred to under Fire-Prevention in Serial No. 3. For same see 3E3b and 3E3c.

1E9 Concrete Fills, and Various Top Coats

Without proper underfills or foundations for cement and composition flooring, for sidewalks, paving and other wearing surfaces, the surfaces cannot fulfil their functions

as to stability and durability. Activities toward standardization of these foundational requirements have resulted in the following publications, specifications and standards:

SERIAL NO. 1

- (a) Office of Public Roads and Rural Engineering, United States Department of Agriculture (1B1c). Portland Cement Concrete Pavements for Country Roads, Bulletin 249.
- (b) National Paving Brick Manufacturers' Association (Serial No. 2). Specifications for the Construction of Vitrified Brick Street Pavements and Country Roads; Green Concrete Foundation; Sand-Cement Superfoundation, and Sand Cushion Type.

Standards:

- (c) American Concrete Institute: (1E1).
- 2. Standard Specifications for Portland cement sidewalks.

- 5. Standard Specifications for one-course concrete highway.
- 6. Standard Specifications for Portland cement curb and gutter.
- 13. Standard Specifications for plain concrete floors.
- 14. Standard Specifications for re-inforced concrete floors.
- 17, 18. Standard Specifications for one and two-course concrete street pavements.
- 19. Standard Specifications for one-course concrete alley pavements.

For Specifications for Foundations for "Plastic-Linoleum" and "Amflorite" composition floors and remarks concerning same, see Industrial Section, p. 174, American Materials Co., Inc.

1E10 Treatment of Concrete and Cement Floors and Surfaces (See, also, 11D4 and 11D6)

- (a) *Practice recommended.* See 1E6f.
- (b) *Standards.* 1E7f and j. 1E9c13 and 14.
- (c) *Experiments* have been started to determine a suitable material for treating the surface of concrete floors to prevent dusting and increase their durability. This work is part of a more comprehensive investigation which is now being outlined to determine proper methods of construction which will mitigate dusting. An abrasion machine has been designed for testing flooring materials which it is believed will give results comparable with the actual wear on floors, and plans have been made for extensive tests on various flooring materials. Results of this investigation

probably will not be available for a year or two. (Report, Bureau of Standards, 1A2a.)

- (d) See, also, Report of Committee under 1D1g.
- (e) See reference to Committee Work (11D6r).
- (f) For information on materials and products employed in the treatment of cement floors and surfaces, see pages in Industrial Section as follows:
 - 1. "Cabot's Stucco Stains," Samuel Cabot, Inc., p. 190.
 - 2. "Lapidolith—Hardener for Concrete Floors" and "Cemcoat—Wall Coating," L. Sonneborn Sons, Inc., p. 191.
 - 3. "Solvay Protective Paints," Semet-Solvay Company, The Solvay Process Co., p. 192.
 - 4. "R. I. W. Cement Filler and Cement Floor Paint and other products," Toch Brothers, p. 193

1F Structural Iron and Steel

From the earliest history of the industry the producers have, closely following first the leading members of the older societies abroad and then of those in this country, coöperated in developing the production of iron and steel to their present state. In addition to the governmental

and other agencies already mentioned, the following organizations are to be noted as among those specifically concerned with development on the structural side. Others concerned with iron and steel in other metallic industries will be referred to in subsequent issues.

1F1 American Foundrymen's Association, Inc.

Secretary: A. O. Backert, 12th and Chestnut Streets, Cleveland, Ohio.

Publications:

- (a) Transactions, a bound volume containing the papers, addresses and discussions at the annual meeting.
 - (b) Pamphlets on papers and addresses at the annual convention.
 - (c) Yearbook containing the names of members and the by-laws.
- Above are free to members, but may be purchased by others at (a) \$5 each, (b) \$5 annually, (c) \$1.50 a copy.

The object is to promote knowledge in the production of castings, and its work is concerned chiefly with gray and malleable iron and steel foundry practice and does not consider non-ferrous metals.

At the annual meeting, committees submit reports which are, after discussion and adoption, printed in the proceedings.

Standards: Practically all of the standards adopted have first been sanctioned by the A.S.T.M. (1A4).

1F2 American Iron and Steel Institute

Secretary: James T. McCleary, 61 Broadway, New York City.

Publications:

Among these are:

- (a) Monthly Bulletin, largely devoted to sociological subjects (housing, sanitation and recreation facilities for employees included).

- (b) Yearbook, giving verbatim report of the proceedings of the general meetings.

- (c) Annual Statistical Report.

- (d) Special statistical bulletins, published from time to time during the year as advance copy from the annual statistical report.

- (e) Iron and Steel Works Directory of the U. S. and Canada, published every few years, latest issue being 1916.

1F3 The Association of American Steel Manufacturers

Secretary-Treasurer: Frank A. Robbins, Jr., care of Pennsylvania Steel Co.,* Steelton, Pa.

Formed about 1895 to standardize the practices of the steel trade and its specifications. Many of the specifications of this Association have later been adopted in whole or in part by other associations and societies and in many cases this Association has gladly relinquished its claims to the original specifications when good use has been made of its pioneer work.

Officers and committees of this Association coöperate in current movements to standardize the specifications and requirements pertaining to steel in its many forms of manufacture and use.

*Bethlehem Steel Co., Steelton, Pa.

Standards: In addition to the "standard specifications" for various other forms of manufactured steel, promulgated by this Association, the "Manufacturers' Standard Specifications for Structural Steel for Buildings" have for many years been referred to by architects and engineers to secure uniformity in estimating conditions and practice. While these are still often referred to, as they differ but slightly from the later standards (1F6) of the A.S.T.M., it is noted that the handbooks of steel companies print the latter specifications rather than the former ones, and, for the sake of uniformity, it is suggested that architects observe the recommendations contained in the introduction by Prof. Thomas Nolan to the A.S.T.M. standards.

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1F4 Information Obtainable

A voluminous literature upon structural design and practice exists, but this lies outside our province. A carefully prepared bibliography or specific recommendations will be sent in answer to inquiries where needs are carefully stated.

1. Reference Handbooks:

- "Engineers' Pocketbook," J. C. Trautwine.
- "The American Civil Engineers' Pocketbook," Mansfield Merriman.
- "Kidder's Pocketbook, 1916."
- "Civil Engineers' Pocketbook," Albert I. Frye.
- "Structural Designers' Handbook," Wm. Fry Scott.

1F5 Practice Recommended

- (a) "Cast Iron Columns, Bases and Lintels," Building Code, 1915. By N. B. F. U. (Serial No. 3).

"Fabrication of Steel Structures." No standards have been officially adopted but the following are in general use:

- (b) "Specifications for Steel Structures, Design, Details of Construction and Workmanship." Adopted, 1912. American Bridge Company. Printed in Carnegie "Pocket Companion," 1916, pp. 154-161. Also in Standard Specifications, distributed by Carnegie Steel Company.
- (c) "Standard Specifications for Fabricated Steel Building Construction." Adopted, 1915. Jones & Laughlin "Manual, 1916," pp. 370-377. Jones & Laughlin.

1F6 Standards

- (a) *Standard Specifications for Structural Steel for Buildings A.S.T.M. Serial Designation A9-16.*

The specifications from which the present standards have developed were first framed and recommended in May, 1900, by that Society, which was then known as the American Section of the International Association for Testing Materials. They were issued in a bulletin which was accompanied by a table epitomizing the salient features of forty different representative specifications of that period, among which in addition to city and many railway engineering adopted specifications was the "Standard Specifications for Structural Steel" of the Association of American Steel Manufacturers. This Association did good pioneer work in its efforts to standardize the specifications and practices of the steel trade.

The Standard Specifications for Structural Steel for Buildings were, as above stated, originally premised by the A.S.T.M., on a careful comparative study of the leading specifications then (1900) in use by railroads, municipalities, consulting engineers, and the American Railway Engineering Association, the Association of American Steel Manufacturers, and others. Since their original adoption in 1901, they have been revised four times, in 1909, 1913, 1914, and 1916, in order to keep them abreast of the progress of the times.

1F7 Current Activities

(a) An important investigation, in progress for a number of years and of value to the engineering and architectural professions, consists of two series of column tests which the Bureau of Standards is making in coöperation with the steel column committees of the American Society of Civil Engineers and of the American Railway Engineering Association.

The series of columns recommended by the American Society of Civil Engineers originally comprised nine different types of cross-section. Each type was represented by

- "Properties of Steel Sections," John C. Sample.
- "Curves for Calculating Beams, Channels and Reactions," Sidney Diamant.
- "Tables of Stresses in Roof Trusses," H. C. Hearne.
- "Structural Engineers' Handbook," Milo S. Ketchum.
- "Handbook Containing General Information for the Use of Engineers, Architects and Builders, 1915," Lackawanna Steel Company.
- "Manual, 1916," Jones & Laughlin.
- "Handbook of Information Relating to Structural Steel, 1916," Cambria Steel Company.
- "Catalogue of Bethlehem Structural Shapes," edition of 1911. Bethlehem Steel Company.
- "Pocket Companion, 1916," Carnegie Steel Company.
- 2. For Shop and Field Inspection facilities and service, see Industrial Section, pp. 142-144, Robert W. Hunt & Company.

- (d) "Instructions for the Mill Inspection of Structural Steel," A.R.E.A. (1A9).

- (e) "Steel Construction," N.B.F.U. Building Code. (3A4d1.)

Angles: The Association of American Steel Manufacturers recommend that certain sections of angles be considered as standard for general building construction and other work. These angles are usually indicated in the steel companies' handbooks by a different-faced type; the use of same, whenever possible, instead of avoidable variations, will tend toward economy in construction through lessening costs of rolling and carrying in stock sizes infrequently called for.

"In these standard specifications will be noted what are termed the permissible variations in the rolling of plates, shapes and bars, and provision should be made in the design to care for such variations. A design which does not permit of this variation is frequently the cause of serious difficulties. Ample clearances tend toward ease and economy in fabrication and greater facility in the erection of any structure."

These specifications are the standards that should be generally followed throughout the United States, and the members of the Institute and all others interested in promoting the very best usages in materials and methods of construction should urge their universal adoption.—THOMAS NOLAN, *Chairman A.I.A. Committee of Materials and Methods.*

These standards will be found printed and illustrated in the book of A.S.T.M. Standards, 1916 (1A4c); also separately (1A4e) also printed and illustrated, together with bridge and other standard specifications, in Carnegie "Pocket Companion, 1916," pp. 10-15; also in Jones & Laughlin "Manual, 1916," pp. 342-347; also in "Standard Specifications," distributed by Carnegie Steel Company.

- (b) By A.S.T.M. (1A4c and e), For Malleable Iron Castings.
- (c) By A.S.T.M. (1A4c and e), For Gray-Iron Castings.
- (d) By A.S.T.M. (1A4c and e), For *Billet Steel Concrete Reinforcement Bars*.
- (e) By A.S.T.M. (1A4c and e), For *Rail-Steel Concrete Reinforcement Bars*.

what was called a light section and a heavy section, and in both the light and the heavy section of each type there were three columns of each of three different lengths.

The American Railway Engineering Association columns originally comprised eighteen latticed columns with rectangular bearing plates at both ends. As in the American Society for Civil Engineers' series, both light and heavy sections, each with three different lengths, were tested, three columns for each length.

Tests upon these two original series have been com-

pleted. A considerable addition has been made to the original American Society of Civil Engineers' program. In order to obtain a relation, if possible, between the ultimate strength and the slenderness ratio, additional columns, totaling thirty-six, have been selected, having such areas, cross-sections and lengths that the slenderness ratio will be different from those embraced in the original series. . . . Twenty-four columns have been added to the series of the American Railway Engineering Association. . . .

The purpose of these tests is to determine the best form of cross-section of columns and also to correct or confirm the formulas used by engineers and architects for calculating the strength of columns. Not alone are such formulas valuable for determining the loads which can safely be

carried by the columns used in various structures, but they also enable the designer of columns to make the most economical use of the steel employed in their construction.

The investigation upon columns will be augmented by the addition of about 250 columns which have been in the possession of the Watertown Arsenal and which will be transferred to the Bureau. (Report, Bureau of Standards, 1916, 1A2a.)

(b) Other tests being conducted in coöperation between the Bureau and the Underwriters Laboratories and Associated Factory Mutuals Laboratories, with reference to columns and beams under fire tests with different protective coverings will be referred to under a later serial number. (See, 3E3b.)

1F8 Preservation of Iron and Steel

The preservation of iron and steel is a very broad problem. The endurance of steel structures depends not only on good materials but on good methods used for their preservation. The following list covers the theory of corrosion, materials used for the protection of steel, their application and manufacture with a logical subdivision into three classes. The most recent investigational work in the United States, done under the auspices of the A.S.T.M. (referred to in a later issue of the Journal in connection with the Paint Manufacturers' Association of the United States), is recorded in the annual volumes of the Proceedings of the American Society for Testing Materials (1A4a and b) and will also be found in the works of Cushman and Gardner. The annual reports of Committee D1, A.S.T.M., on "Protective Coatings for Structural Materials," from 1903 to 1914 inclusive, are very valuable and are published by the A.S.T.M. in the form of a single volume of 557 pages which may be obtained from the Secretary at the price of \$3.50. (See Research, Tests and Paint Materials, 12B.)

A. Corrosion of Steel.

- (1) "Corrosion and Preservation of Iron and Steel," Cushman and Gardner.
- (2) "Corrosion of Iron and Steel," Alfred Sang.
- (3) "Corrosion of Iron and Steel," J. N. Friend.
- (4) "An Electrolytic Method of Preventing Corrosion of Iron and Steel," by J. K. Clement and L. V. Walker, Bureau of Mines (2).
- (5) "Corrosion of Fence Wire," Bulletin 239, U. S. Department of Agriculture.
- (6) "Electrolytic Corrosion of Iron in Soils," U. S. Bureau of Standards (1A2c), No. 25.

B. Protective Coatings.

- (1) "Paints for Steel Structures," Houston Lowe.
- (2) "Rustless Coatings," M. P. Wood.
- (3) "Iron Corrosion, Anti-fouling and Anti-corrosive Paints," L. E. Andes.
- (4) "Commercial Paints and Painting," Arthur S. Jennings.
- (5) "Lead and Zinc Pigments," C. D. Holley.
- (6) "The Preparation and Uses of White Zinc Paints," P. Fleury.
- (7) "White Paints and Painting Materials," W. G. Scott.

C. Manufacture of Oils and Pigments.

- (1) "Chemistry and Technology of Paints," 2nd edition, Maxmilian Toch.
- (2) "The Manufacture and Comparative Merits of White Zinc and Zinc White Paints," G. Petit.
- (3) "Linseed Oil and Other Seed Oils," Wm. D. Ennis.
- (4) "Paint Technology and Tests," Henry A. Gardner.

D. Other References. See Reference Handbooks 1F4.

1. The subjects of corrosion, protection and preservation of iron, steel and other metals as applied to other products will be treated under the respective industries.

See the general index for these. Especial mention will, however, be found under:

Corrosion and Treatment of Metals (11B2).
Protective Coatings (11B3).
Electrolysis (6N and 11B4).
Metal Products in General (11B5).
Roof Coverings, also Sheet Metal Work, Cornices, Skylights, and Ventilators (11D2).
Research, Tests, and Paint Materials (12B).
Treatments and Coatings for Metals and for Walls and Floors, exclusive of Wood (12C).

E. For other information pertaining to materials and products for the treatment of Iron and Steel, see pages in the Industrial Section as follows:

"Solvay Protective Paints," The Solvay Process Company, Semet-Solvay Company, p. 192.
"R. I. W." Tocholith and other products, Toch Brothers, p. 193.
"Patton's Ironhide," Patton Paint Co., p. 194.

1F8f Current Activities (addenda)

At the Convention in June, 1917, of the A.S.T.M., at Atlantic City, Committee A-5 on Corrosion of Iron and Steel submitted a report from which the following is quoted:

"Committee A-5 has completed the erection of the test racks described in its report for 1915, and all the sheets of metal are now exposed. Those at Annapolis, Md., and Pittsburgh, Pa., were placed on the racks during October and December of 1916 and those at Fort Sheridan, Ill., in April of this year.

"The Inspection Committee, with a number of members of Committee A-5, inspected the sheets at Pittsburgh and Annapolis last April and made notes on their condition. Certain peculiarities were observed, indicating differences between the conditions of the various sheets at both locations, but it was decided that no specific report could be made at present.

"Subcommittee II on Preservative Metallic Coatings for Metals, which was created last year, has concluded its study of the determination of zinc in galvanized coatings. It presents a report on a comparison of the basic-lead-acetate and the hydrochloric acid-antimony chloride methods of treating galvanized sheets and wire, which it is believed is a valuable contribution to the testing of these products."

(See Report of Subcommittee II in "Proceedings," A.S.T.M., 1917, Part I, pp. 144 to 177, including diagrams, tables and discussion which followed report.)

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2A1 United States Geological Survey; Department of the Interior

Created by act of Congress, March 3, 1879; organized July 1, 1879

Director: George Otis Smith, 1330 F Street, Washington.

Publications:

(a) Annual Report of the Director. "Mineral Resources of the U. S.," in two parts. (b) Part 1, "Metals." (c) Part 2, "Non-Metals." (d) Chapters of same, as pamphlets for earlier distribution. (e) Monographs. (f) Professional papers. (g) Bulletins. (h) Water-supply papers. (j) Topographic Atlas of the U. S., folios and separate sheets. (k) Geologic Atlas of the U. S., folios. (l) Chapters of certain of classes *f* and *g* separately issued for early distribution.

Publications of the classes lettered *e*, *j*, and *k*, are sold at cost; the others (unless prices are affixed in the lists given) are distributed free as long as the stock lasts. It is impossible for the Survey to comply with general demands for the publications which are distributed free, such as to have all of any series sent, but requests for a certain paper are granted whenever practicable. No person can obtain more than one copy of any publication. Many of the publications of the Survey are out of print, but these can usually be obtained by purchasing from the Superintendent of Documents, Government Printing Office, Washington, D. C., or can be consulted at public libraries or purchased from dealers in second-hand books in any large city.

For publications to which prices are affixed in the lists given under the various industries prepayment is required, and should be made in cash (exact amount) or by postal or express money order (not postage stamps) payable to the Director of the United States Geological Survey, or to the Superintendent of Documents if the Survey's stock is exhausted.

Descriptive circulars and indexes in regard to topographic atlas sheets and monthly notices announcing the issue of new publications will be sent to those who request them.

Complete catalogue of all publications of the Survey obtainable without charge upon application to Director of Geological Survey, Washington, D. C.

Contributions of the United States Geological Survey to Architects

(Written for the Journal)

By ERNEST F. BURCHARD

Geologist in Charge, Section of Non-metallic Resources

A broad, comprehensive study of the non-metallic structural materials resources of the United States is being made by the U. S. Geological Survey in coöperation with the Bureau of Standards and Bureau of Mines. The Survey studies in the field and office, the occurrence, character, and distribution of the materials, classifies them

according to their source, petrographic character, geologic origin and age, commercial uses and suitability for special purposes, and summarizes annually the commercial output and value of all these materials.

The Bureau of Standards tests in the laboratory the physical properties of the materials and makes comparative studies of their durability through observations of materials in use under various conditions. The Bureau of Mines studies in the field the technology of production and preparation for the market of the various materials, paying particular attention to the principles of safety, efficiency, and prevention of waste. Both the Bureau of Mines and the Survey collect materials for test by the Bureau of Standards, taking care not to duplicate work.

The forerunner of this coöperative work was a general field and laboratory investigation carried on by the Survey for several years prior to July, 1910, primarily for the information of the Supervising Architect with regard to structural materials available for the construction of projected federal buildings throughout the United States, but also designed to add to the Survey records data concerning materials of promise in any region under survey. The reports to the Supervising Architect were brief—generally about five typewritten pages. They were sent directly from the field without awaiting publication by the Survey. The work was carried on by geologists especially interested in the subject, and in order that there should be uniformity in the reports they were prepared mostly according to the following outline, which indicates the range of non-metallic materials studied by the Survey then, as well as now:

Structural Materials investigated for use in Federal Buildings:

I. Stone: *A.* Dimension stone for exterior. *a.* Foundations. *b.* Walls. *c.* Sills and trim. *B.* Ornamental stone for interior (marble, serpentine, onyx, etc.) *C.* Slate for roofing, sanitary fixtures, etc.

II. Material for concrete: *A.* Sand. *B.* Gravel. *C.* Crushed stone, slag, cinders, shells, etc. *D.* Cement (Portland, natural, hydraulic, etc.).

III. Clay products: *A.* Brick: *a.* Common. *b.* Front (pressed, rough, fire-faced, etc.) *B.* Tile: *a.* Roofing. *b.* Hollow building-tile or block. *c.* Ornamental.

IV. Materials for mortars and plasters: *A.* Lime: *a.* Quick. *b.* Hydrated. *B.* Gypsum wall-plasters. *C.* Sand.

Necessarily the work was done very rapidly, and the reports were written not for the use of geologists, but rather for that of persons who may not have had training in geology, care being taken that only data of practical character should be given. The points of special interest to the geologist, however, such as the nature, extent, quality (as to uniformity, durability, and color), location (as to means of handling and transportation), structure, and geologic relation in general, that affected the

use of materials, were borne in mind throughout the series of reports.

In these field studies the endeavor was to relieve the laboratory of all the work possible and to give the Supervising Architect a definite opinion as to the value and availability of a material, backed up by a detailed description of it and the results of a simple field-test. In addition, use was made of any authentic test data in possession of the producer or contained in state or federal geological survey reports. The common points considered with regard to stone, gravel, clay, gypsum, etc., were noted on special forms in loose-leaf books. Many special details had to be considered with regard to the various materials, and for brick and other clay products notes of a special form were kept regarding the processes of manufacture. Sands were subjected to qualitative tests for the presence of lime, alkali, clay, magnetite, quicksand, and silt. Granular metric analyses were made and the material was critically examined under the field-lens.

A knowledge of the Supervising Architect's general specifications was requisite, and after a little practice the geologist was able to tell in most cases, after a careful investigation, whether a sand, gravel, stone, or brick would fulfil these specifications or no.

The direct advantages of these reports to the Supervising Architect or to federal construction work in general may be summarized as follows:

1. Attention was called to materials of merit which, owing to their proximity to the building-site, should be obtainable at lower prices than similar materials from long distances.
2. Attention was called to little-developed and hitherto comparatively unknown materials that may possess special merit for certain kinds of work.
3. Warning was issued against the use of materials that are not suitable yet that are commonly used in certain localities.
4. Warning issued against the acceptance of materials from deposits which may be of good quality but of insufficient quantity.
5. Warning was issued against the acceptance of materials from deposits which may afford excellent material in small samples, but whose quality in adequate quantities is irregular and inferior.
6. Data regarding local costs and freight rates were given on small and large lots of all materials shipped into the locality, such as cement, stone, sand, wall-plasters, etc., thus affording aid toward preparing specifications for buildings.
7. Some attention was paid to the proposed federal building-sites, with reference to character and condition of the ground on which foundations would rest and with reference to smoke conditions.

In addition to the results of this work as related to the Government, its relation to the country at large may be mentioned. When little-known but meritorious materials were thus brought to the attention of the Supervising Architect, and incidentally to that of the public by use in federal buildings and by published reports, the efficient use of important natural resources was encouraged. In many instances materials that would probably otherwise have been passed unnoticed were brought to the attention of the Supervising Architect. Many such instances might be noted, but the following are fair samples showing the range of such materials covered.

1. Large and sound glacial boulders of both crystalline and sedimentary rocks that occur in great abundance in the vicinity of Minot, N. D., a region otherwise devoid of

stone. These boulders can be split and trimmed into handsome, massive dimension stones.

2. The "chats" or tailings from the concentrating mills in the Platteville, Wis., and Joplin, Mo., zinc districts, and from the copper smelter at Great Falls, Mont., etc. These "chats" make a good aggregate for both plain and reinforced concrete work, and the tailings from the Great Falls smelter make good sand for mortar and brick.

3. Sandstone used locally at Big Stone Gap, Va.
4. Oolitic limestone at Bowling Green, Ky.
5. Subcrystalline limestone at Batesville, Ark., Frankfort, Ky., and Harriman, Tenn.
6. Shale near Mansfield, Ohio, suitable for brick-making.

7. Loam at various points in the Mississippi embayment in Arkansas, Mississippi, and Tennessee, suitable for the manufacture of brick.

8. Sand and gravel from points on Arkansas River in Kansas and Oklahoma very similar in quality to the well-known Kaw River sand.

Besides the work outlined above, there have been carried on at times at the laboratories of the Survey and the Bureau of Standards in Pittsburgh and Washington special investigations of such subjects as the manufacture and the hydration of lime and studies of Portland and Keene's cements and wall-plasters, tending toward the formulation of standard specifications for these materials in Government construction work. Here again the services of field geologists have been required and the geologic records of the Survey incidentally enriched. In areal field-work geologists frequently visit places containing developed and undeveloped deposits of limestone, sandstone, granite, slate, Portland cement and concrete materials, and gypsum, and the many special papers are either direct or incidental results of such work.

Papers published by the Geological Survey on structural materials available in parts of Oregon and Washington, at Minneapolis, Minn., at Austin, Tex., on the fire-resistive properties of various building materials, and on the effects of the San Francisco earthquake and fire on structures and structural materials, are examples of the results of the type of studies outlined above.

The annual volume entitled "Mineral Resources of the United States" furnishes architects and others with reliable and up-to-date information concerning many of the various materials which enter into construction. Each year statistics are compiled concerning over sixty subjects, giving the production, exports, imports, and value—information of vital interest to all who are dealing with both metallic and non-metallic mineral products. This information for each year is given as soon after the close of the year as possible, but of late years a provisional estimate has been made and published by the first of the year following the year for which the statistics are given and still more lately statistics on many of the important resources have been published semi-annually.

One very important phase of Survey work on structural materials remains to be mentioned. Special investigations have been made, or are in progress, in which certain geologists spend the whole or a large part of their time at certain periods studying a single subject in a district, a state, or throughout the United States. These special investigations have resulted in the publication of papers or bulletins on such subjects as the brownstones of Pennsylvania, the Bedford oolitic limestone of Indiana, the Portland cement materials of the United States, the gypsum deposits of the United States, the stone resources of the United States (illustrated by maps showing the locations of quarries by classes of stone), the granites

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of Maine, the granites of the southeastern states, the marbles of western Vermont, the marbles of southeastern Alaska, building-stones of Minnesota, glass-sand in the Mississippi Basin, the clays of the United States east of the Mississippi River, and slate in the United States.

The profession of the architect requires special knowledge in so many diverse branches that it is not surprising that heretofore comparatively few have had the time or the inclination to inquire into the source and nature of the raw materials that enter into construction work. That there is an increasing interest in these subjects is, however, evident through the correspondence being received by the federal Geological Survey, especially from teachers of

architecture and from architects who are seeking materials suitable for special purposes, for certain localities and climates, or in order to carry out definite color-schemes. To all such inquiries the Survey is endeavoring to respond to the best of its ability and to place at the disposal of architects and builders the results of its experience and its knowledge of the structural materials, resources of the United States, not only in the non-metallic materials, but in the metals, such as iron and steel, manganese, copper, lead, and zinc. The further use of the resources and services of the Survey is cordially invited and suggestions as to how this service and coöperation may be improved and extended will be welcomed.

2A2 State Geologists

Publications:

- (a) Bulletins, reports and circulars are issued on behalf of many of the states, forty-seven of which recognize geologic work as a necessary and proper governmental function. These publications are generally furnished upon request.

The coöperation existing between state and federal geological surveys is both intimate and extensive in the conduct of topographic surveys, stream-gaging, and geologic investigations, as well as in the collection of mineral statistics.

In part the federal survey acts as the disburser of state funds in this technical work, in part the state official acts as the representative of the larger organization in local work, and again the national survey investigates some large interstate problem in behalf of adjoining states. Each of these coöperative methods is effective and prevents duplication of effort, accomplishes standardization of results, and promotes the coördination that secures the general results for the national bureau and the more local benefits for the state organization.

2A3 Bureau of Mines, Department of the Interior, U. S. A.

Created by Act of Congress, May 16, 1910. Organized July 1, 1910.

Director: Van. H. Manning, 710 E St., Washington, D. C.

Publications:

- (a) Annual Report of the Director; (b) Bulletins; (c) Technical Papers; (d) Miners' circulars.

A limited number of those current, one only to each person, is free upon application to the Director.

NOTE: Publications of especial interest to architects and constructors will be referred to under the respective activities. For complete list of publications apply to the Director.

The great importance of the mine-safety and fuel investigations undertaken by the Geological Survey, and

the widespread demand for a separate bureau to pursue these and other mining inquiries resulted in Congress passing an act, effective July 1, 1910, which established the Bureau of Mines, at the same time that the Structural Materials Laboratories of the Geological Survey the Engineer in charge of which was Richard L. Humphrey, were transferred to the Bureau of Standards.

While the Bureau's activities are confined to questions of safety and efficiency in the mining and utilization of the great variety of mineral products, there are necessarily places here and there where its work bears more or less directly upon subjects of architectural interest. These will be referred to in connection with the respective industries.

2A4 Society of Constructors of Federal Buildings

Secretary: Frederick A. Hills, New Post Office, Rumford, Maine.

Publications:

- (a) Journal, devoted to professional papers and discussions, cost data, changes of addresses of members and contract news relative to United States public buildings.

Purpose:

Is a mutual organization of the field and office staffs of the Supervising Architect's office of the Treasury Department, but has no official connection with the Department. The members are engaged in the design, construction, equipment and maintenance of United States public buildings.

2A5 Building Data League, Inc.

President: Sullivan W. Jones, 15 West 38th St., New York, N. Y. *Secretary:* F. A. Burdett, 15 West 38th St., New York, N. Y.

An Association, the membership of which embraces persons acting in either a professional or contractual capacity as agents of the consumer in the field of building construction.

Annual dues are \$10, and the service consists of reports on research work, reports on investigations of products, and the preparation and publication of standard specifications for distribution to members.

Publications:

- (a) "Standard Specifications" embodying general information in establishing standards for measuring the comparative worth of competing products in the given classes.
(b) "Findings" on registered products.
(c) Reports on non-registered products.
(d) Bulletin, issued to members at intervals.

The "Findings" and reports are based upon the standards established by the specifications.

2B Lime and Hydrated Lime

The subjects under this heading will be treated herein with respect to their uses in foundational work, masonry, and in mortars generally—but not specifically in connection with “plastering,” to which reference will be fully made in a later Serial Number. (See “Metal, Plastic and Other Products,” Serial No. 11.)

2B1 Lime

The lime manufactured and sold in the United States in 1915 amounted to 3,589,699 short tons, valued at \$14,336,756.

The quantity produced for building purposes according to the figures given in “Lime in 1915,” issued by the U. S. Geological Survey (2A1d), on the basis of about one third of the total, was 1,163,433 short tons, valued at \$5,068,375, or an average price per ton of \$4.36 received by the producers. In this amount was included 581,114 tons of hydrated lime.

2B2 National Lime Manufacturers' Association

President: W. E. Carson, Riverton, Va.

(Information concerning same difficult to obtain.)

2B3 Information Obtainable (Lime)

Publications:

- (a) The source, manufacture and use of lime, “Mineral Resources of the United States” for 1913, pt. 2, pp. 1509-1593, 1914, E. F. Burchard and W. E. Emley.
- (b) See also chapters on lime in “Mineral Resources of the United States” for each year (2A1c and d).
- (c) The U. S. Geological Survey has also issued a large number of bulletins and separate chapters (2A1d and g) dealing with lime, and other structural materials to be found in various parts of the country. Specific information will be furnished through the Journal or the publications may be had upon application to the Director as noted under 2A1.
- (d) Proceedings and other publications of the National Lime Manufacturers' Association (2B2).
- (e) Bureau of Standards, Technologic Paper (1A2c) “The Manufacture of Lime.”
- (f) Ditto, “The Properties and Uses of Lime.”
- (g) “Treatise on Limes, Hydraulic Cements and Mortars,” Gen. Q. O. Gilmore.
- (h) “American Civil Engineers' Pocket-Book,” M. Merriman; “Lime and Lime Mortar,” pp. 518-520.
- (j) “Cements, Limes and Plasters,” E. C. Eckel.
- (k) “Building Construction and Superintendence,” F. E. Kidder; “Limes, Cements and Mortars,” pp. 126-204.
- (l) Other information pertaining to lime, generally in connection with its use in mortars for masonry, will be found in most of the publications mentioned under “2C4. Other References.”

2B4 Hydrated Lime

The hydrated lime sold in the United States continues steadily to increase, the amount produced in 1915 being stated under “Lime.”

The average price per ton, though fluctuating, has on the whole been declining since 1911, when it was \$4.50. These changes may suggest that the production of hydrated lime has reached such proportions that its future growth will be at a slower rate than formerly, but as the quantity sold by producers in 1915 amounted to only 16 per cent of the total lime sold, there is ample room for future growth, especially in view of the marked attention now being given to this kind of lime. The superiority of hydrated lime over lump lime for building is receiving broader recognition, due in part to the activity of the Hydrated Lime Bureau, a branch of the National Lime Manufacturers' Association.

An elaborate series of experiments on the properties and uses of hydrated lime, including its effect upon concrete, has been commenced by the United States Bureau of Standards (see “Current Activities”). In addition to these developments, improvements have been made in lime hydrators and in the design of lime-hydrating plants, and a process for increasing the plasticity or spreading quality of hydrated lime by the addition of a limited quantity of clay during hydration has been patented by W. E. Carson (From “Lime in 1915,” 2A1d).

2B5 Hydrated Lime Bureau of the National Lime Manufacturers' Association

Manager: Norman S. Hough, Arrott Building, Pittsburgh, Pa.

The object of the Bureau is to furnish a central office from which architects, engineers and contractors may receive reliable information relative to the use of hydrated lime for building purposes.

Publications:

Books, bulletins and pamphlets, some of which are referred to under 2B6 and 2B8.

2B6 Information Obtainable (Hydrated Lime)

Publications:

- (a) See also Chapters on lime in “Mineral Resources of the U. S.” for each year (2A1c and d).
- (b) “Hydrated Lime,” by E. W. Lazell, 95 pp. Published by Jackson-Remlinger Printing Co., Pittsburgh, Pa., 1915; distributed by the Hydrated Lime Bureau, Pittsburgh, Pa. (A general elementary text on the history, chemistry, manufacture, properties, and uses of hydrated lime.)
- (c) “Hydrated Lime,” by W. B. Joseph, Cement and Engineering News, February, 1915, pp. 45-46. (A brief account of the processes of manufacture and properties of hydrated lime.)
- (d) “Effect of Adding Hydrated Lime” (to Portland cement), Cement and Engineering News, March, 1915, p. 76. (Cities experiments by Henry S. Spackman, who concluded “that the addition of hydrated lime will be found advantageous under ordinary climatic conditions in concrete work generally, where it is exposed either to air or to fresh water; and concrete to which such additions have been made, besides being more impermeable, will show less change in volume under varying moisture content.”)
- (e) Papers read at the thirteenth annual meeting of the National Lime Manufacturers' Association and published in the minutes of the meeting, February, 1915: “Hydrated Lime Plastering—the Fourth Year's Development,” by Lawrence Hitchcock; “The Possibilities of Hydrated Lime Products for Plastering Purposes,” by H. S. Spackman; “Hydrated Lime in Oregon State Roads,” by R. S. Edwards; “Hydrate as an Addition to Concrete,” by E. M. Soper; “A Modern Hydrating Plant,” by R. K. Meade.
- (f) “Advantages in Use of Commercially Hydrated Lime over Ordinary Slaked Lime,” by E. W. Lazell, Cement and Engineering News, June, 1915, pp. 125-126.
- (g) “Perfecting Concrete Roads—the Part That Hydrated Lime Plays in Assuring Absolute Permanency to Concrete,” by Charles Warner, Cement and Engineering News, September, 1915, pp. 198-200.
- (h) Papers read at the fourteenth annual meeting of the National Lime Manufacturers' Association, Cleveland, Ohio, February, 1916 (published in the minutes of the meeting).

The following are some of the pamphlets and bulletins published by the Hydrated Lime Bureau. (Those referring to “wall plastering” will be mentioned under a later Serial number. See No. 11.)

- (j) “Tests and Uses of Hydrated Lime,” A. C. Hoff. A reprint from the Current Era of February, 1915.
- (k) “Dependable Concrete—Hydrated Lime and its Effect on,” Bulletin A.2.
- (w) “In the Concrete Chute,” Bulletin A. 3.
- (l) “Improving Paving Grout,” Bulletin L.

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- (n) "Improved Cement Blocks," Bulletin M.
- (o) "Concrete Gas Tank Waterproofed with Hydrated Lime," Pamphlet D.
- (p) "Waterproofing Concrete with Hydrated Lime."
- (q) "Improving Concrete Roads," Pamphlet K.

2B7 Other References

See "Kidders Pocket Book," 1916, pp. 1462-1467, for lime and a brief description of the process of making hydrated lime. Other references will be found in most of the publications concerned with masonry mentioned under 2C4 and also under 2B3.

2B8 Practice Recommended by Various Authorities

Hydrated Lime Bureau (2B5).

- (a) "The Ideal Mortar for Brick Masonry—Mortar No. 5," Bulletin J, June 1, 1916. (Contains results of investigation conducted by Prof. J. S. Macgregor, of Columbia University, New York City.)

Standard specifications for plastering and other practice recommended for the use of lime and hydrated lime will be referred to under "Plastering" in a later Serial number. (See No. 11.)

2B9 Standards Adopted

By Navy Department, U. S. A.

- (a) Specifications for "Concrete and Mortar, and Materials for (cement not included)," Serial designation 59C2c, adopted February 1, 1916, copies of which can be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, provide for lime, lime-paste, lime-cement mortar.

By American Society for Testing Materials (1A4c)

- (b) "Standard Specifications for Quicklime," Serial designation C5-15.
- (c) "Standard Specifications for Hydrated Lime," Serial designation C6-15.

By Department of Commerce—Bureau of Lighthouses

(d) *Whitewash Formulas*. A document with this title is issued which describes what is generally known as "Government Formula" for whitewash of which a verbatim transcript is—

WHITEWASH

The following formula for whitewashing has been found by experience to answer on wood, brick, and stone, nearly as well as oil paint, and is much cheaper:

Slake half a bushel of unslaked lime with boiling water, keeping it covered during the process. Strain it and add a peck of salt, dissolved in warm water; three pounds of ground rice put in boiling water and boiled to a thin paste; half a pound of powdered Spanish whiting, and a pound of clear glue dissolved in warm water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and when used put it on as hot as possible, with painters' or whitewash brushes.

A SIMPLER WHITEWASH

The following formula for mixing whitewash, when properly made and put on, gives a white that does not easily wash or rub off, viz:

To ten parts of best freshly slaked lime add one part of best hydraulic cement; mix well with salt water and apply quite thin.

By United States Congress

(e) *Standard Sizes of Barrels*.

The Sixty-third Congress passed a bill (H. R. 4899) which became effective July 1, 1916, making the standard size of barrels for all dry measures as follows:

"Length of staves, 28½ inches; diameter of heads, 17⅞ inches; distance between heads, 26 inches; circumference at bilge, 64 inches, outside measurement; thickness of staves not greater than ⅛ inch. It is further provided that any barrel of different form having a capacity of 7,056 cubic inches, shall be a standard barrel."

Opposition to this bill among lime-producers caused the introduction of another bill in the Sixty-fourth Congress, entitled "An act to standardize Lime Barrels" which was approved August 23, 1916, all provisions of the act to become effective January 1, 1917, by which there was established a large and a small barrel of lime, the large barrel to consist of 280 pounds and the small barrel to consist of 180 pounds net weight. (The provisions of these two bills are set forth in "Lime in 1914" and "Lime in 1915" (2A1d) and "A General Statement in Regard to the Standard Lime Barrel Law" has been issued by the Bureau of Standards.)

2B10 Current Activities

(a) *Recent developments* in the building-lime trade, by which old objections to lime as a building material are being overcome, are reasons for encouragement. The principal development is the increased use of hydrated lime in preference to lump lime, and the greater care and accuracy required in the process of manufacture of hydrated lime. The danger of pitting or "popping" of wall-plaster, due to incomplete hydration of lime, is eliminated by the use of thoroughly prepared hydrated lime. From "Lime in 1915," 2A1d.

(b) *Wet-Mortar Plants*. An interesting development in the lime industry is described by William C. Hay in "How Lime Can Be Reestablished in the Plaster Field," Bulletin No. 7, National Lime Manufacturers' Association (advance of minutes, April, 1916).

It is the introduction of a new type of wet-mortar plant that has been in operation for two years in some of the large building centers of the Pacific coast, manufacturing hard-lime mortar, masonry mortar, finishing putty, and other products. The plant buys kiln-run lime in bulk. It is of the continuous type. The lime is drawn from tight storage-bin into slaking-tank, and after the quicklime has been hydrated or slaked to the consistency of thick cream, it is strained off into curing-vats, the lighter fluid into the "plaster-vats" and the remainder into the "masonry vats."

After aging, the putty is mechanically aerated by violent agitation, after which it flows through a feed-valve to mixer. Here it comes in contact with sand and Keene's cement, which also feed continuously and uniformly, the cement discharging into the sand-feeder before the sand reaches the mixer. As this mass is being churned through the mixer, fiber or hair is fed by a steadily running "draper" to a picking-drum which disintegrates and feeds the hair in finely separated strands into the cold and continuously mixing mass of mortar. From the end of mixer the mortar is elevated to measured steel loading-tanks, from the bottom of which auto trucks of 4 cubic yards capacity are loaded by the opening of a gate. The expense of hauling the extra weight of water in the wet mortar is said to be negligible where auto trucks are employed.

Imperfections due to carelessness of laborers mixing the mortar or to incomplete slaking of the lime are eliminated, as the finished mortar is delivered ready for spreading. It may, however, like unmixed hydrated lime, be kept for days without noteworthy deterioration.

It is estimated that in 1915 these wet-mortar plants purchased approximately 8,000 tons of lime from pro-

ducers, and sold approximately 90,000 tons of mortar, valued at about \$270,000, or about \$3 a ton.

(c) *Alca Lime*. A recent development in the lime industry, is a patented article offered for sale by many licensees in the U. S. under the Spachman patents. See description in "Kidder's Pocket Book," 1916, p. 1467.

(d) *Properties of Hydrated Limes*. In 1915 the American Society for Testing Materials adopted the standard specifications for hydrated lime. (Referred to under "Standards Adopted.") It was desired to learn just how the material made by different manufacturers compared with the requirements of these specifications. This will serve the double purpose of giving information as to the qualities of different brands of hydrated lime, and also enable one to form an opinion as to the justice of certain limiting values placed in the specifications. At the present time samples have been examined from about one fourth of all the factories in the United States.

Hydrated lime consists chiefly of calcium hydroxide and generally contains more or less magnesium hydroxide. In the ordinary process of manufacture there is danger of forming a hydrated lime which has "burned during hydration," a gritty, non-plastic, yellow material, which has a tendency to expand when wet. It is supposed that this phenomenon is caused by partial decomposition of the calcium hydroxide due to the heat generated during the slaking. A study of the temperature required to decompose calcium hydroxide under different conditions was undertaken to eliminate, if possible, this difficulty.

—From Report Bureau of Standards, 1916, 1A2a.

(e) *Properties of Lime-Cement—Sand Mortars*. It has become general practice to add small quantities of hydrated lime to cement mortars, either for plastering or masonry in order to make them work more freely. It is desirable to know just what effect this lime has on the properties of the mortar. A large number of mortars of varying proportions of the three ingredients have been tested for compressive and tensile strengths when stored in air or under water, expansion, adhesion to brick and plasticity.

—From Report Bureau of Standards, 1916, 1A2a.

(f) *Hydrated Lime in Concrete*. Hydrated lime, in small amounts, is being added to a great deal of the concrete now being used for various reasons. It is important to know how such an addition will affect the properties of the concrete. At the request of the Bureau an advisory committee, composed of engineers, contractors, and lime and cement manufacturers, has helped to plan an exhaustive research on this subject. It is hoped to determine (1) what proportion of hydrated lime is best for different kinds of concrete, (2) whether or not there is a difference in the behavior of high calcium and high magnesian hydrate, and (3) what effect hydrated lime has on the following properties of concrete: compressive strength, segregation of aggregate, adhesion to reinforcement, resistance to abrasion, resistance to sea water, expansion, absorption of water, and permeability to water.

—From Report Bureau of Standards, 1916, 1A2a.

(For other references see "Waterproofing and Damp-proofing," 1D, and "Metal, Plastic, and other Products," Serial No. 11.)

2C Stone Masonry, Broken Stone, Sand and Gravel

In treating of stone for building purposes, rough stone, which is a localized product, will be referred to only in connection with masonry, and broken or crushed stone principally for its use in concrete.

Crushed stone is the largest factor in the stone industry at the present time. In 1907, owing particularly to the great increase in the building of macadam roads, the total value of crushed stone exceeded that of exterior building stone, and the excess in value has been increasing almost continuously ever since.

The following are among the organizations interested in the promotion of products allied with these industries; as a representative of the industrial activities there exists the International Union of Bricklayers, Masons and Plasterers, which is a trade union for advancing the interests of its members.

2C1 *Inter-State Stone Manufacturers' Association*

Incorporated 1913 under the laws of the state of Ohio, not for profit
Acting Secretary: Claude Clark, Columbus, Ohio.

Formed to promote, and increase the use of stone.

Standards: (a) Has formulated standards for numbers and sizes of aggregates of broken stone, which, it is stated, will appear in new specifications of the State Highway Department of Ohio.

2C2 *The National Association of Sand and Gravel Producers*

And other associations exist which are interested in the production and use of rough and broken stone, sand, gravel and other "builders' supplies." These will be referred to as their work toward standardization of materials or practice comes to our notice.

2C3 *Information Obtainable*

- (a) The U. S. Geological Survey has issued many bulletins (2A1d and g) dealing with rubble and range rock, broken stone, sand, gravel and other structural materials to be found in various parts of the country. Specific information will be furnished by the Journal or the publications may be had upon application, to the Director. (See 2A1.)
- (b) See chapters on "Stone" in "Mineral Resources of the U. S." for each year (2A1c and d).
- (c) "Production of Glass Sand, Other Sand, and Gravel in 1909" (includes numerous analyses): "Mineral Resources of the U. S." for 1909, E. F. Burchard. Pt. 2, 1911, pp. 519-542.
- (d) See also chapters on "Sand and Gravel" in "Mineral Resources of the U. S." for each year (2A1c and d).
- (e) For the relative value of various aggregates, including round- and sharp-grained sands, gravels and other materials and proper methods for testing aggregates see Technical Paper No. 58 referred to in 1E4 m.
- (f) For specific information on roads and road materials, apply to the Journal.
(See also 1D1p, 1E9, and 2B6.)
For masonry and foundations, see also 1C1 and 1C2.
For waterproofing and dampproofing, see 1D and 11C2.
For broken stone, sand, and gravel in concrete and for concrete foundations, see 1E4, 5 and 6.

2C4 *Other References*

- (a) "A Treatise on Masonry Construction," Ira O. Baker.
- (b) "Masonry," Malverd A. Howe.
- (c) "The American Civil Engineers' Pocket Book," M. Merriman. Masonry, Foundations, Earthwork, Highway Engineering.
- (d) "Kidder's Pocket Book," 1916.
- (e) "Building Construction and Superintendence," F. E. Kidder. Part 1. Masons' Work.
- (f) "The Building Estimators, Reference Book," F. A. Walker.
- (g) "Design of Walls, Bins and Grain Elevators," M. S. Ketchum.
- (h) "The Building Trades Handbook," Masonry Construction.
- (j) "Standard Specifications," J. C. Ostrup.
- (k) "Handbook of Cost Data," H. B. Gillette.
- (l) "Strength of Materials," Edward R. Maurer.
- (m) "A Practical Treatise on Foundations," W. M. Patton.
- (n) "The Building Mechanics' Ready Reference," H. S. Richey. Stone and Brick Masons' Edition.

STRUCTURAL SERVICE BOOK

- (o) Rock Excavating and Blasting, J. J. Cosgrove.
- (p) "Trautwine's Civil Engineer's Pocket Book."
- (q) "Highway Construction," A. J. Byrne and A. E. Phillips.
(See also 2J Stone in General.)

2C5 Practice Recommended by Various Authorities (See also Serial No. 1, C, D, and E)

- By American Railway Engineering Association (1A9f):
- (a) "Waterproofing of Masonry."
- By National Board of Fire Underwriters (Serial No. 3):
- (b) "Building Code Recommended," 1915—Part VI, "Walls," pp. 34-50, 86; Part XXVI, "Chimneys, Flues and Heating Apparatus," pp. 173-184.
 - (c) "Dwelling Houses, A Code of Suggestions for Construction and Fire Protection," 1916—Part III, "Walls," pp. 21-31; Part VI, "Chimneys, Flues, Smoke pipes and Fireplaces," pp. 50-64.
- By N. F. P. A. (Serial No. 3):
- (d) "Specifications for Construction of a Standard Building," in which is stated "The construction of buried footings is not considered a part of these specifications; retaining walls, if built of stone, must be plastered on the exposed side with $\frac{3}{4}$ inch of cement mortar," and "If cap-stones are used, they shall be protected against fire by 4 inches of fireproofing," no other reference to stone being permitted in a "Standard Building."
- By American Society for Testing Materials (1A4c):
- (e) "Tentative Standard Method for Form of Specifications for Certain Commercial Grades of Broken Stone," Serial designation D35-16.

2D1 Stone: For Building and Decoration

(a) The development of the stone industry in the United States is fostered and encouraged by the U. S. Geological Survey. In the effective quarrying and methods of production the Bureau of Mines coöperates with the Survey and with the producers. The Bureau of Standards likewise coöperates with all. (See Mr. Burchard's article under 2A1.)

An awakening is now taking place to the importance of a better understanding of the kinds of stones to be used in buildings and the best method to be employed for their finish and setting. To quote from "Stone in 1915" (2A1e):

"There has been a tendency by some producers to market only stone of the finest quality, even for mediocre uses, instead of conserving resources and using second- or third-class stone where the highest degree of appearance is not demanded. Stone rated as second or third class in appearance may be the equal of first-class stone in strength and durability, a statement well supported by the fact that stones now regarded as inferior in appearance have been exposed in buildings of the older cities of the country for as much as 50 or even 100 years without appreciable evidence of deterioration. Exposure for such periods is the most reliable of all tests of building stone."

2E1 Granite (For name and address of Secretary of recently organized National Building Granite Quarries Association, Inc., see 12L23)

In 1915, the granite production of the United States was valued at \$17,864,000, divided as follows (by millions): Building 4.7, monumental 4.87, paving 2.35, crushed 3.82, the balance in curbing, flagging, rubble and riprap. Importations, \$144,382.

In connection with this industry there exist the following national and locality organizations:

2E2 National Association of the Granite Industries of the United States

Secretary: Robert D. Smith, 161 Devonshire St., Boston, Mass.

It is the purpose of this organization to associate in a central body all persons, firms or corporations engaged in carrying on any department of the granite industry in any part of the United States.

Serial No. 2

- (f) For certain practice recommended with reference to roadwork see 2C3f.

2C6 Standards Adopted

- By Navy Department, U. S. A.:
- (a) Specifications for "Concrete and Mortar and Materials for (cement not included)," Serial designation 59C2c, adopted February 1, 1916, copies of which can be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, provide for Sand for Concrete, Sand for Mortar, Broken Stone, Gravel, Lime-cement-mortar.
- By American Railway Engineering Association:
- (b) "Standard Specifications for Stone Masonry" (1A9f), containing Classification of Masonry, Definitions, Cement (same as 1E7a), General Requirements, Bridge and Retaining-Wall Masonry, Ashlar Stone, Rubble Stone, Arch Masonry, Dry Masonry.
- By American Society for Testing Materials (1A4c):
- (c) "Standard Sand," mentioned in "Specifications and Tests for Portland Cement," Serial designation C9-17.
 - (d) "Standard Definitions of Terms Relating to Materials for Roads and Pavements," Serial designation D8-15.
 - (e) The A. S. T. M. has issued a considerable number of standard tests and methods in connection with macadam rock, broken stone, bituminous and other materials used in roadwork, under the Serial designation D. (1A4c and e.)
- By Inter-State Stone Manufacturers' Association:
- (f) Numbers and sizes for aggregates of broken stone (2C1a). For reference to lack of Standards with respect to the "perch" and other forms of measurement, see 2J8.

"Another fact worth mention here is that the settling of dust and smoke upon the surface of light-colored stone soon obscures its original color so that there is no appreciable difference in appearance between first-class and second-class stone. If more consideration were given to the probable appearance of a building after it is a few years old than to its appearance when it is new, the cost of the stone could probably be lessened without impairing its durability in the least."

With reference to stone for building and other purposes the publications of the U. S. Geological Survey are numerous and complete. Besides treating of all stone produced annually in chapters on stone in "Mineral Resources of the U. S." (2A1c), these chapters are issued separately for earlier distribution. Some of the bulletins and other documents pertaining to particular stone industries or localities are mentioned under the various subdivisions of stone and under "Stone in General."

It is quite impossible to list the publications of the various state geologists (2A2) the names and addresses of which organizations may be had upon application to the Journal.

"The fact that there are three distinct divisions in the industry, viz., quarrying, manufacturing for building and paving work, and manufacturing for monumental purposes, is recognized, but inasmuch as neither of these divisions can conduct business without relations with one of the other two divisions, it is considered imperative that all three divisions be comprehended in this organization, provision being made so that the specific values and rights of each department may be preserved."

2E3 The Granite Manufacturers' Association of Barre, Vermont

Secretary: Harold P. Hinman, Barre, Vt.

Consists of over 97 per cent of the quarry owners and manufacturers in the Barre granite center, to promote the best interests of the Barre granite industry. Coöperates

with the Quarry Owners' Association in a campaign to increase the volume of sales and to improve the quality of memorial and building work.

Publications:

- (a) A house organ known as "Barre Granite" for distribution to members and discussion of the affairs of the Association.

2E4

Other locality granite associations, concerning whose activities and publications we have not heard, exist in Hardwick, Vt., Milford, N. H., Concord, N. H., Quincy, Mass., and Westerly, R. I.

2E5 Information Obtainable

(A to K, U. S. Geological Survey. To obtain, see 2A1.)

- (a) "The Granite Industry of the Penobscot Bay District, Maine," G. O. Smith. Bulletin No. 260, pp. 489-492, 1905. (Exhausted.)
 (b) "Recent work on New England Granites," T. N. Dale. Bulletin No. 315J, pp. 356-359, 1907.
 (c) "The Granites of Maine," T. N. Dale. Bulletin No. 313, 202 pp., 1907. 35 cents.
 (d) "The Chief Commercial Granites of Massachusetts, New Hampshire, and Rhode Island," T. N. Dale. Bulletin No. 354, 228 pp., 1908.
 (e) "The Granites of Vermont," T. N. Dale. Bulletin No. 404, 138 pp., 1909. 20 cents.

2F1 Marble

The marble production from twenty-one states in the United States in 1915 was valued at \$6,738,000, of which by far the largest part was used in building. Dressed Vermont marble appears to have averaged \$3.20 per cubic foot, while Georgia undressed averaged \$1.10, and Tennessee undressed, \$1.79. Importations in 1915, \$600,000.

"Onyx" marble, or travertine, is quarried in small quantity annually. In 1915 the average price on the total output of 4,574 cubic feet, from Utah, Kentucky and New Mexico, was \$4.21. Importations in 1915, \$30,000.

In this industry there appears to be no national association composed entirely of producers but there does exist the:

2F2 National Association of Marble Dealers

Incorporated under the laws of New York, 1903

Secretary: Wm. A. Davis, 1328 Broadway, New York City.

Confines its activities to interior marble and has prepared, adopted, and circulated a Code of Practice (2D7a) governing conditions of estimating, awarding of contracts, grades of marble and workmanship.

The membership includes practically all of the important dealers in the United States, exclusive of New York City and the Pacific coast; also includes quarriers, many of whom are finishers as well.

In September, 1913, this Association entered into a five-year agreement (2D7b) with the Bricklayers', Masons' and Plasterers' Union, establishing a standard wage rate throughout the country for the installation of marble, which warrants direct contracts between the architect, owner, or general contractor, and the marble dealer.

The Association has indorsed the standard documents of the American Institute of Architects (1A8g) and looks forward to their more complete use as a solution of many controversies not now eliminated by the Code of Practice referred to.

Publications:

- (a) "Code of Practice." Adopted at the Annual Meeting in New York, November 11, 12, 1915. Copies furnished upon request.
 (b) "Agreement" (referred to above), copies of which may be had upon request.
 (c) Bulletins to members at frequent intervals.

- (f) "Supplementary Notes on the Granites of New Hampshire," T. N. Dale. Bulletin No. 430, pp. 346-372, 1910. 60 cents.
 (g) "Granites of the Southeastern Atlantic States," T. L. Watson. Bulletin No. 426, 282 pp., 1910.
 (h) Supplementary Notes on the Commercial Granites of Massachusetts, Bulletin No. 470, pp. 240-290, 1911.
 (j) "The Granites of Connecticut," T. N. Dale and H. E. Gregory. Bulletin No. 484, 137 pp., 1911.
 (k) "The Aberdeen Granite Quarry, near Gunnison, Colo." J. F. Hunter. Bulletin No. 540, pp. 359-362, 1913. 45 cents.
 (l) See, also, chapters on "Stone" in "Mineral Resources of the U. S." for each year (2Ac and d).

2E6 Other References (See, also, 2J4 and 5)

- (a) "History of the Granite Industry of New England," Arthur W. Brayley.
 (b) For announcement of the purposes of the National Building Granite Quarries Association, Inc., and list of members, see p. 201 in the Industrial Section.
 (c) For information concerning Milford granites, see Industrial Section, p. 202, Webb Pink Granite Co.

2E7 Practice Recommended by Various Authorities

(For Mausoleum Specification, notes formulated by Presbrey-Coykendall Company, see Industrial Section, p. 203.

2F3 Information Obtainable

(A to H, U. S. Geological Survey. To obtain, see 2A1.)

- (a) "Tennessee Marbles," Arthur Keith. Bulletin No. 213, pp. 366-370, 1903. (Exhausted.)
 (b) "Marble of White Pine County, Nev., near Gandy, Utah," N. H. Darton. Bulletin No. 340G, pp. 377-380, 1908.
 (c) "Marble in Chiricahua Mountains, Arizona," D. Siney Paige. Bulletin No. 380, pp. 299-311, 1909. 40 cents.
 (d) "Variegated Marble Southeast of Calera, Shelby County, Ala.," Charles Butts. Bulletin No. 470, pp. 237-239, 1911.
 (e) "The Commercial Marbles of Western Vermont," T. N. Dale. Bulletin No. 521, 170 pp., 1912.
 (f) "Ornamental Marble near Barstow, Cal.," Robert W. Pack. Bulletin No. 540, pp. 363-368, 1913. 45 cents.
 (g) "The Calcite Marble and Dolomite of Eastern Vermont," T. N. Dale. Bulletin No. 589, 67 pp. 1915.
 (h) See also chapter on "Stone" in "Mineral Resources of the U. S.," for each year (2Ac and d).

The Bureau of Mines is investigating problems connected with the mining and technology of various building stones. The following will be found descriptive of the production of this building material:

- (j) "The Technology of Marble Quarrying." Bull. No. 106 (2A3b).

2F4 Terrazzo Floors and Marble Floors

- (a) An interesting series of papers treating of same, with suggested specifications, by Charles A. Marsh, Ernest L. Hesse, Carl C. Holloway and David C. Trott, contained in Journal of the Society of Constructors of Federal Buildings (2A42) for November, 1914. See, also, "A Recent Experience with Terrazzo Work," listed under 11D4, and other references of interest under 11D4.

2F5 Other References (See, also, 2J4 and 5)

- (a) "Marble and Marble Workers," W. S. Renwick.
 (b) "Notes on Domestic White Building Marble" Topic 1081, Bulletin of Building Data League (2A5).

2F6 Current Activities

The National Association of Marble Dealers is investigating the entrance of finished foreign marble into this country free of duty, and has established arbitration methods for settling disputes as to the grades and workmanship of marble. (See "Code of Practice," 2F2a.)

2G1 Limestone

Limestone was produced in the United States, in 1915, to the value of about \$35,000,000. Pennsylvania, Ohio, Indiana, New York, Illinois, Missouri, Michigan and Virginia led in the order named, with productions of over \$1,000,000. Only about \$3,000,000 of this total represents building stone, the balance (in millions) being used largely for flux 9.6, concrete 5.3, ballast 3.6, and road metal 8.16. Large quantities were also used in the making of cement.

The average price per cubic foot for rough building stone dropped from 21 cents per cubic foot in 1914 to 17 cents in 1915, while the average for dressed stone dropped in the same period from 52 cents per cubic foot to 47 cents.

Much work is being done by producers toward improving the conditions of production, sale, and transportation.—Notes from "Stone in 1915."

2G2 Indiana Limestone Quarrymen's Association

Secretary: R. M. Richter, Bedford, Indiana.

A voluntary organization of producers of limestone formed for the purpose of diffusing information about this material and its applications and for promoting its greater use.

It is understood that this Association will take up officially the question of recommendations or specifications for the setting of limestone and will welcome the suggestions or comments of architects. (See letter from Secretary under Practice Recommended, 2G6.)

Publications:

- (a) "Indiana Limestone," Vol. I. (See 2G5b for later issues.)

2G3 Bedford Stone Club Auxiliary

Secretary: R. M. Richter, Bedford, Indiana.

Organized to bring about better conditions in the limestone trade as between the cut-stone contractor in this district and the general contractors throughout the country.

Publishes a circular enunciating these principles.

2G4 Information Obtainable

(A to J, U. S. Geological Survey. To obtain, see 2A1.)

- (a) "The Limestone Quarries of Eastern New York, Western Vermont, Massachusetts, and Connecticut," H. Ries. Seventeenth Annual Report, pt. 3 (continued), pp. 795-811, 1896.

2H1 Sandstone

The production of sandstone in 1915 was valued at about \$6,000,000, of which about \$1,400,000 was in building stone, the balance representing ganister, paving, curbing, flagging and rubble.

2H2 "Bluestone"

"The figures of production for bluestone, most of which is quarried in southeastern New York and northeastern Pennsylvania, are included in those of sandstone. This stone is used chiefly for flagging, for curbing, and for sills, lintels, steps, and house copings.

"The bluestone trade, like other branches of the stone industry, is said to have suffered through lack of organization and coöperation on the part of producers and lack of insistence on the use of only first-class material where such material alone could give satisfaction." "Stone in 1915."

- (b) "The Bedford Oolitic Limestone of Indiana," T. C. Hopkins and C. E. Siebenthal. Eighteenth Annual Report, pt. 5 (continued), pp. 1050-1057, 1897.
 (c) "The Bedford Oolitic Limestone (Indiana)," C. E. Siebenthal. Nineteenth Annual Report, pt. 6 (continued), pp. 292-296, 1898.
 (d) "Limestones of Southwestern Pennsylvania," F. G. Clapp. Bulletin No. 249, 52 pp., 1905.
 (e) "Cement Materials and Industry of the United States," E. C. Eckel. Bulletin No. 243, 395 pp., 1905. (Treats of limestone.) 65 cents.
 (f) "Limestone and Dolomite in the Birmingham District, Alabama," Charles Butts. Bulletin No. 315G, pp. 247-255, 1907.
 (g) "Oolitic Limestone at Bowling Green and Other Places in Kentucky," J. H. Gardener. Bulletin No. 430, pp. 373-378, 1910. 60 cents.
 (h) "The Oolitic Limestone Industry at Bedford and Bloomington, Ind.," J. A. Udden. Bulletin No. 430, pp. 335-345, 1910. 60 cents.
 (j) "Portland Cement Materials and Industry of the United States," Bulletin No. 522, 401 pp. (Treats of limestone.)
 (k) "Some Notes and Letters on Bedford Stone," Fremont B. Ward. In Journal of the Society of Constructors of Federal Buildings (2A4a), November, 1914.
 (l) "Report of the Committee on Stone Inquiry," referred to under 2J4f and g, treats of limestone.

2G5 Other References (See, also, 2J4 and 5)

- (a) "Indiana Limestone" being Vol. 1, now current, the first of a series to be issued by the Indiana Limestone Quarrymen's Association (2G2a).
 (b) For later issues of "The Indiana Limestone Library" and for "Condensed Information" on Limestone, see Industrial Section, p. 145 of the Indiana Limestone Quarrymen's Association.

2G6 Practice Recommended by Various Authorities

(January 31, 1917)

"In connection with specifications to cover the setting of Indiana limestone, we have to suggest the following:

"The Indiana Limestone to be plastered on the back with $\frac{3}{4}$ inch of lime-mortar—rake out all joints on face to avoid spawling, point up at completion with equal parts of non-staining cement and clean white sand."

"It is our further opinion, however, that it would be advisable to apply on the back of the stone one heavy coat of hot asphalt before plastering same; also, as a precaution against staining, we would advise that the walls of the building be covered each night and at all times during cessation of work, in order that rain, snow or frost may be prevented from getting into the brick wall, causing possible discoloration by reason of same."

(Signed) INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION

(For later and further practice recommended, see Industrial Section, p. 145.)

2H3 "Flagstone"

This is a name very commonly misapplied. In certain sections of the country, notably in Pennsylvania, where bluestone is largely used for sills, steps, copings, paving of terraces, garden walks and other purposes where roughness of texture is sought or smoothness is not a desideratum, it is commonly designated as "flagstone." This should be considered as referring to the treatment rather than the stone, for to the trade this means any good bluestone or other sandstone, ranging in color from gray through a blue-gray to a purplish tint, which has natural split surfaces on the flat exposure and bed and the thickness of which runs within the limitation of about $1\frac{1}{2}$ to 4 inches. Above this thickness it becomes bluestone stock.

2H4 Information Obtainable

- (a, b, c, U. S. Geological Survey. To obtain, see 2A1.)
- (a) "The Sandstones of Western Indiana," T. C. Hopkins. Seventeenth Annual Report, pt. 3, pp. 780-787, 1896.
- (b) "Brownstones of Pennsylvania," T. C. Hopkins. Eighteenth Annual Report, pt. 5, pp. 1025-1043, 1897.

2J1 Stone in General

"The stone industry as a whole has advanced with the development of the country in spite of severe competition with brick, Portland cement concrete, and certain other artificial stone products. The use of these materials has seriously affected the production of the lower grades of stone for foundations and to a less degree the production of building stone of higher grade, but it has had little or no effect on the use of monumental stone."—"Stone in 1915," 2A1e.

"The producers of building granite in the United States have an idea to try to interest the general public in granite, and will also work directly with architects and builders.

"The ordinary man who builds knows little or nothing about stone and frequently he cannot tell one variety of stone from another. Truth compels the admission that a surprisingly large proportion of architects is also woefully ignorant concerning one of the most important materials of construction. These people need to be told, not once nor spasmodically, but constantly and convincingly, of the nature and physical characteristics of stone, of its eventual cheapness because of its durability, and of its beauty, fitness and adaptability for every kind of building work. This is a task that does not belong to the individual quarry or stone mill, but to those associations that are formed to foster the interests of the entire trade."—"Stone."

Representing the interests of the stone industry in general there are two large national organizations which contain many producers within their memberships. These are:

2J2 International Cut-Stone Contractors' and Quarrymen's Association

Secretary: Wm. A. Guthrie, 1 West 42nd St., New York City.

Holds an annual convention at which addresses are given and papers read concerning developments and progress in the stone industry. Purposes, membership and publications not stated.

2J3 National Retail Monument Dealers' Association

Secretary: Frank Mallon, Port Huron, Mich.

Purpose is to elevate the standard of the trade and to encourage the production of the best kinds of monumental work.

At each annual convention an exhibition is held exemplifying the progress in granite, marble and bronze work. For the next meeting and exhibition in Philadelphia, August, 1917, the coöperation of architects is to be invited. (A Code of Ethics was adopted. The Editor of the S. S. D. was privileged to address the meeting.)

2J4 Information Obtainable

- (a and b, U. S. Geological Survey. To obtain, see 2A1.)
- (a) "The Effects of the San Francisco Earthquake and Fire on Various Structures and Structural Materials, Richard L. Humphrey.

- (c) Sandstone is discussed in "Structural Materials Available near Minneapolis," in Bulletin No. 430, 1910. 60 cents.
- (d) The Ohio State Survey, Prof. J. A. Bownocker, State Geologist Columbus, Ohio, has published a bulletin on "Building Stones" in which sandstone is referred to.
- (e) "Report of the Committee on Stone Inquiry" referred to under 2J4g touches on sandstone.
- (f) See, also, references under 2J4 and 2J5.

Bulletin No. 324 of the U. S. Geological Survey, 1907. Pp. 14-61. 50 cents. Also pp. 62-130 in same, "The Effect of the San Francisco Earthquake on Buildings, Engineering Structures and Structural Materials," J. S. Sewell. The next following Bulletin also deals with the effect of fire on building stone.

- (b) "The Fire-Resistive Properties of Various Building Materials," Richard L. Humphrey. Bulletin No. 370, U. S. Geological Survey, 99 pp., 1909. 30 cents.
- (c) In the annual report of the Chief of Ordnance, Watertown Arsenal, referred to under 1B1b will frequently be found results of tests on various building stones.
- (d) There are some deposits of building stone within the state of Mississippi that are worthy of consideration. These are described in Bulletin No. 12 recently issued by the Mississippi State Geological Survey, E. N. Lowe, director.
- (e) "Setting and Pointing Stonework," Carl C. Holloway in Journal of the Society of Constructors of Federal Buildings (2A4a) November, 1914.
- (f) "Report of the Committee on Stone Inquiry," (2A4a), in Journal just referred to, January, 1916. Preliminary Report.
- (g) "Ditto, Later Report, Journal for Dec., 1916.
- (h) "Stones for Building and Decoration," by Prof. S. B. Merrill, Curator of Geology in the U. S. National Museum, Washington, D. C.

2J5 Other References

- (a) "Report on the Compressive Strength, Specific Gravity and Ratio of Absorption of the Building Stones in the United States," General Q. O. Gilmore.
- (b) "Building Stones and Clays, Their Origin, Character and Examination," E. C. Eckel.
- (c) "Modern Stone-Cutting and Masonry," John S. Siebert and F. C. Biggin.
- (d) "Masonry and Stone-Cutting," E. Dobson.
- (e) "Building Construction and Superintendence," F. E. Kidder. Part I, "Building Stones," pp. 205-262 and pp. 878-891; "Cut-Stone Work," pp. 263-310.
- (f) "Building Stones and Clay Products. A Handbook for Architects," Heinrich Ries.
- (g) "American Civil Engineers Pocket Book," M. Merriman. "Stone Quarrying and Cutting," pp. 496-508.
- (h) "Building Trades Handbook." "Materials of Masonry Construction," pp. 145-228.
- (j) "Fire Prevention and Fire Protection," J. K. Freitag. Pp. 216-219.
- (k) "Engineering Geology," H. Ries and T. L. Watson.
- (l) "Engineering Contracts and Specifications," J. B. Johnson.
- (m) Trautwine's Civil Engineer's Pocket Book.
- (n) See, also, Industrial Section, the pages referred to under each kind of stone separately.

2J6 Soapstone

In the production of soapstone the United States ranks first among all countries, and Virginia produces about twenty times as much as the four other producing states—Maryland, North Carolina, Rhode Island, and Vermont. The waste from breakage in quarrying, sawing into slabs, manufacturing, and final transportation is so great as to render success in the industry a matter of skilful manipulation. The value of the stone is in large measure proportionate to the work done upon it. In the rough it is valued at \$2 or less a ton, but when sawed into slabs its value is increased to about \$15, and when made into laundry-tubs it may attain a value of about \$30 a ton. The production of soapstone and talc in the United States is steadily increasing.—U. S. Geological Survey, Press Bulletin, November, 1916.

2J7 Practice Recommended by Various Authorities

There is a lack of information from organized sources with respect to building stones and their best uses. This may be due partly to the fact that so much of the stone produced is used for other than building construction.

Recommendations of individual writers and authorities and of well-known producers or companies will be found under Information Obtainable and Other References.

By the National Board of Fire Underwriters (Serial No. 3):

- (a) "Building Code Recommended," 1915. Weights of Materials, p. 84; Concrete and Masonry, Compression, 86; Part VI, Walls, pp. 34-50.
- (b) "Dwelling Houses, A Code of Suggestions for Construction and Fire Protection," 1916. Part III, Walls, pp. 21-31.

2J8 Standards

The Lack of Uniformity in Measuring Stone.

Owing to the variety of uses to which stone is put, there is no regular unit of measurement employed by the quarryman, the stone being sold by the cubic yard, cubic foot, ton, cord, perch, rod, square foot, square yard, square, or other unit. Building and monumental stone, especially the dressed product, is usually sold by the cubic foot or the cubic yard, although this unit varies with the class of stone and with the locality. A large quantity of the rough stone is sold by the perch, cord, or ton. Rubble and riprap, including stone for such heavy masonry as breakwater and jetty work, are generally sold by the cord or ton. Fluxing stone and stone for chemical use is sold by either the long or the short ton. Flagstone and curbstone are sold by the square yard or the square foot, the thickness being variable and dependent on the orders received. Crushed stone is reported as sold by the cubic yard or ton, the short ton being more generally used.

The perch is legally defined in many older states as $24\frac{3}{4}$ cubic feet; in some states, and even within a single state, it varies from $16\frac{1}{2}$ through 20, 22, 25 to 27 cubic feet; and in others it is defined as equivalent to 2,200, 2,500, 2,700, 2,800, and 3,000 pounds. The cord in some states is measured in feet—for instance, 128 cubic feet in the quarry or 100 feet in the wall; in others it denotes weight and is variously defined as equivalent to 11,000, 12,000, 12,500, and 13,000 pounds. The weight of a cubic yard of crushed stone varies from 2,300 to 3,000 pounds, the average weight being about 2,500 pounds. In certain localities this crushed stone is sold by the "square" of 100 square feet by 1 foot, or 100 cubic feet. It is also of interest to note the selling of crushed stone by the bushel, $21\frac{1}{2}$ bushels representing a cubic yard of about 2,700 pounds.

[EDITOR'S NOTE.—The above quotation from "Stone in 1915" (2A1d) emphasizes the necessity for concerted action in bringing about, if possible, uniform methods of measurement for stone in all parts of the country. This matter will be brought to the attention of the Institute's Committee on Materials and Methods in the hope that through its subcommittees in the various Chapters some line of action may be determined upon to assist in bringing about standardization.]

2J9 Current Activities

Investigation of Building Stones in the United States.

(a) In coöperation by the Geological Survey with the Bureau of Mines, 200 samples of marble, limestone, sandstone, and granite have been collected from various quarries in all sections of the country. Testing has been confined chiefly to the marbles, and includes the determination of compressive strength, on wet and dry specimens, on bed and on edge, transverse perpendicular and parallel to bed, percentage of water absorption, tensile strength perpendicular and parallel to bed, specific gravity, weight

per cubic foot, porosity, hardness, coefficient of expansion, heat conductivity, electrical conductivity, and resistance to the action of frost. Various building stones submitted by other Government departments and state governments have been investigated to determine their suitability for particular purposes. A collection is being made of samples of all the important building stones for the establishment of a permanent file. At present seventy-five slabs of polished marble, 8 inches by 12 inches, have been collected from typical quarries in the eastern and southern states. These will be filed in a manner to enable persons interested to study and compare the general features of the different types. This collection when complete will consist of samples from all the principal quarries of the country. A paper containing the results of the tests available on building stones will probably be published during the ensuing year. (Report Bureau of Standards, 1916.)

(b) The Bureau of Mines (2A3) is investigating problems connected with the mining and technology of various building stones. Bulletin No. 106, "The Technology of Marble Quarrying (2F3j), was recently published and a report on the quarrying of sandstone will shortly be issued.

(c) The International Cut Stone Contractors' and Quarrymen's Association of North America has conducted an investigation of the air-hammer as injurious to the users. Some of the results of the inquiry are reported in the Association's monthly leaflet.

(d) *Automatic Freezing and Thawing Apparatus for Testing Building Stones.*

"A unique apparatus has been designed to automatically move a charge of stone, concrete or other material back and forth from a freezing-chamber to a thawing-chamber at the intervals required to completely congeal and thaw the contained moisture. With this apparatus it is expected that 80 or 100 freezings can be made in one day. Thus, a great number of freezings on a sample of stone or other material can be made. By comparison of the results with actual observations on structures showing disintegration at the end of a known period of exposure, it will be possible to predict with some degree of accuracy the number of years' service that can be expected from any material under these conditions."—From the Report, Bureau of Standards 1916, 1A2a.

2J10 Current Comment

(a) *Selling Stone by Sample.*—"Stone is a product of Nature's laboratory, and there may be decided variations within a single bed or ledge. For this reason there are few problems before the quarryman of greater importance than the preparation of the samples upon which he is to depend for the bringing of business.

"When an architect is considering stone, his fancy may be captivated by particular markings or by a special tint or shade in the sample before him. He specifies this stone, but when it is delivered on the job he finds that only a small percentage of it has those peculiar qualities. The quarryman may truthfully say that all stone is likely to show variations in its natural bed, and that it is utterly impossible to match exactly a small sample in the entire material for a great building. But what shall he say when the architect asks him why it is that his sample apparently represents only 10 per cent of the quarry output, instead of the remaining 90 per cent? Even if his stone is finally accepted for the building, it is a poor business policy if he has disappointed a purchaser.

"The wisest business judgment dictates that all samples submitted in competition should be chosen with the most scrupulous care to show 'the run of the quarry.'

"In most quarries the stone varies more or less widely in different beds. In other words, Nature has graded it herself. The trouble often is that the quarryman does not follow this excellent example and grade the stone for the trade. He will submit a sample of what is Grade No. 1 and then wonder that he has difficulty in getting a good deal of Grade No. 2 accepted on the job. If the dealer would frankly submit samples of both the first and second grade stone, and make a difference in the price of each, he

would find that it would frequently bring him business. The inferior stone may be exactly as strong and durable and fit for building work as the better grade, differing only in some slight point of appearance. Architects would often be willing to use the second grade stone in certain parts of some buildings, where it could not possibly be noticed from the street-level, if they found that this would materially lessen the cost of the structure."—*Stone*, July, 1916.

2K1 Slate

The slate resources of the country, like the other mineral resources, are treated in publications of the U. S. Geological Survey, particularly in Chapters on Slate issued annually (2A1c and d) from which the statistical and other information within quotation-marks in this section is taken.

The total value of the slate sold in 1915 was: roofing slate \$3,746, 334; mill stock \$819,672.

In this industry no National Organization appears to exist but some locality organizations have been formed. Information about them seems to be difficult to obtain, though one from which we have heard is:

2K2 Bangor Slate Association, Incorporated

Secretary: L. M. Cowling, Bangor, Pa.

Composed of producers in this locality who manufacture slate for roofing or structural purposes.

To give information about genuine Bangor slate and to see that it is used when specified is the sole object of this Association.

Standards:

Has adopted a trade-mark, registered in the U. S. Patent office, a duplicate of which, according to the booklet of the Association (2K2a), is pasted on the reverse side of every slate marketed from the genuine Bangor Vein.

Publications:

- (a) Booklet entitled "Genuine Bangor Slate" for general distribution (not dated or numbered).
- (b) Specifications for "Genuine Bangor Slate Roofs for Flat Roofs" (over concrete and over sheathing) upon request.

2K3

"The slate production of the United States is practically confined to the northeastern part of the country. Although scattered deposits, more or less developed, occur elsewhere, this eastern slate is shipped to supply markets on the western coast as well as in the central and southern parts of the country. The slate of most of the deposits in the various states has been described either in Bulletin No. 586 of the U. S. Geological Survey or in previous reports on the slate industry. Slate is classified as roofing slate and mill stock, and the use for these different purposes depends largely, although not entirely, on character of the slate."

(a) *Mill Stock*: "Mill stock requires a finer, more even-grained, and more compact material than roofing slate, and a material with a smooth cleavage surface. It must be of a fairly uniform color and not too hard to be easily worked by the slate-dressing machinery. The slates of Maine and Vermont and the 'soft-vein' slates of Lehigh and Northampton counties, Pa., are well adapted for mill stock, and these slates are also among the best of the roofing slates. The Arkansas slate has been used both for electrical and roofing purposes, and the Maryland and New York quarries also furnish a small quantity of mill stock."

"Mill stock includes slate used for blackboards, school slates, flooring, wainscoting, vats, tiles, sinks, laundry-tubs, grave-vaults, sanitary ware, refrigerator shelves, flour-bins and dough-troughs for bakeries, electrical switchboards, mantels, hearths, well-caps, and tops for billiard, laboratory, kitchen, and other tables."

"Lehigh and Northampton counties, Pa., report the only stock produced for school slates and blackboards. The quarries in these counties can best produce this material on account of the unusually fine cleavage of the slate and the thickness and size of the beds."

(b) *Roofing Slate*: "Slate used for roofing is not necessarily of so fine a texture nor of so smooth a cleavage as the mill stock, but it must be hard, strong, and tough, and should not contain carbonates or iron pyrites, which decompose or oxidize under atmospheric conditions. A description of the process of dressing roofing slates was given in the report on slate in 'Mineral Resources' for 1911. (2K4m.)"

"Nearly 73 per cent of the value of the slate production in the United States in 1914 was represented by slate for roofing, and the roofing-slate output from Pennsylvania and Vermont represented, respectively, about 59 and 29 per cent of the total value of the roofing slate produced. Besides roofing slate Pennsylvania and Vermont produce also mill stock; practically the only use of slate from the other producing states, except Maine, is for roofing."

2K4 Information Obtainable

The following are listed from selected publications through the courtesy of the U. S. Geological Survey (2A1); other lists will be furnished upon application to the Journal.

- (a) "Chemical Notes on the Composition of the Roofing Slates of Eastern New York and Western Vermont," W. F. Hillebrand. Nineteenth Annual Report, pt. 3, pp. 301-305, 1899. \$2.25.
- (b) "The Slate Belt of Eastern New York and Western Vermont," T. N. Dale. Nineteenth Annual Report, pt. 3, pp. 153-200, 1899. \$2.25.
- (c) "The Slate Industry of Slatington, Pa., and Martinsburg, W. Va.," T. N. Dale. Bulletin No. 213, pp. 361-364, 1903. (Exhausted.)
- (d) "Notes on Arkansas Roofing Slates," T. N. Dale. Bulletin No. 225, pp. 414-416, 1904. 35 cents.
- (e) "Slate Deposits of California and Utah," E. C. Eckel. Bulletin No. 225, pp. 417-422, 1904. 35 cents.
- (f) "Slate Investigations During 1904," T. N. Dale. Bulletin No. 260, pp. 486-488, 1905. (Exhausted.)
- (g) "Note on a New Variety of Maine Slate," T. N. Dale. Bulletin No. 285, pp. 449-50, 1906. (Exhausted.)
- (h) "The Slates of Arkansas," A. H. Purduc. Bulletin No. 430, pp. 317-334, 1910. 60 cents.
- (j) "Slate Deposits and Slate Industry of the United States," T. N. Dale and others. Bulletin No. 586, 1914. A revised edition of Bulletin No. 275.
- (k) The state geological surveys of Arkansas, California, Maryland, and New Jersey have published descriptions of the slate and the slate deposits of these states, and information as to these publications may be had by applying to the respective state geologists.
- (l) A publication by E. C. Eckel, "Building-Stones and Clays, Their Origin, Character, and Examination," contains a chapter on slate, which gives information on the slates of the United States and of foreign countries and also many analyses and tests of slate.

2K5 Other References

- (a) "Kidder's Pocket Book, 1916." (See its Index "Slate.")
- (b) "American Civil Engineers Pocket Book," M. Merriman.
- (c) "Building Construction and Superintendence," F. E. Kidder. Part I, "Slates," pp. 241-247, 892-899.
- (d) "Building Trades Handbook. "Slate Roofs," pp. 314-317, 366-367.
- (e) "Fire Prevention and Fire Protection," J. K. Freitag. Pp. 521-522 682-684.
- (f) Trautwine's Civil Engineer's Pocket Book.
- (g) "Carnegie Pocket Companion 1916." Pp. 339-341.
- (h) "Genuine Bangor Slate." Booklet (2K2a.)
- (j) For descriptive data on Bangor Slate, of the North Bangor Slate Co. See Industrial Section, p. 204.

2K6 Practice Recommended by Various Authorities

(a) *Thicknesses.*—It has been suggested that a failure to recognize a certain minimum thickness for slates has been unfavorable to the industry; that some producers are in the habit of splitting their slates too thin; and that the insistence by architects and the general public on thicker slates would result in much less breakage, a higher standard of splitting and sorting slates, and the marketing of a product of higher grade. The minimum thickness suggested is three sixteenths of an inch for the strongest slates and fully a quarter of an inch for the common slates of somewhat less strength. The growing demand for thicker slates to produce rough effects should assist in this development of the industry. ("Stone in 1915" 2A1d.)

(b) *Slope.*—Slate makes a good roof if of good quality and properly watched. It breaks easily and cannot be walked on without damage to the slate.

Tile of good quality gives good results. It is not so tight as slate, but does not break easily. It has architectural value and its use is growing with improvement in the product and in the variety of colors.

Slate and tile of suitable quality, properly protected and fastened, can be recommended on roofs with a pitch of six (6) inches to the foot or over, where expense is not the governing feature, and where they aid in producing the desired architectural effect, except that where there is much chance of driving snow, eight (8) inches to the foot should be the flattest slope allowed. (Committee on Buildings, American Railway Engineering Association, 1A9e.)

(c) *Flat Surfaces.*—Slate is being much used for flat roofs and for terrace paving, garden walks and similar purposes. For concrete underfills for latter uses see 1E9 and for a suggested flat roof treatment see "Standard Specifications for Use over Concrete" as put forth by the North Bangor Slate Company in collaboration with the Barrett Manufacturing Company, printed on page 204 of the Industrial Section.

(d) By the National Board of Fire Underwriters (Serial No. 3): "Building Code Recommended," 1915. Part XV. "Roofs and Roof Structures." Pp. 102-108.

(e) By the National Board of Fire Underwriters (Serial No. 3): "Dwelling Houses, A Code of Suggestions for Construction and Fire Protection," 1916. Part IV "Roofings, Approved Fire-Resistive Materials for." P. 135.

2K7 General Standards

(a) *Roofing Slate—Navy Department Specifications.* Serial designation 59S1, February 1, 1915.

General:

(1) Slate shall be of the dimensions specified, not less than $\frac{3}{16}$ inch thick, best quality, uniform in size, color, texture, and composition; sound, dark blue or black, or other color desired. Tails and edges shall be cut square and true. Nail-holes shall be drilled and countersunk for the heads of nails. Slate shall be free from warped surfaces, quartz ribbons, or quartz particles, and the presence

of injurious carbonates and sulphides shall be cause for rejection. Where unfading slate is desired, or the slate is to be exposed to acid fumes, slates which effervesce with hydrochloric acid applied as follows shall be rejected: Hydrochloric acid having a specific gravity of about 1.20 at 60°F. or about 38 per cent of absolute acid is to be diluted so that 60 per cent by volume of the diluted acid shall be water. This acid is to be applied to the freshly broken edges of the slate.

Trade Name:

(2) Bidders shall state trade name of slate, name and locality of quarry, and, where required, submit sample of the slate which they propose to furnish.

NOTE.—Copies of the above specifications can be obtained upon application to the various Navy pay offices or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. (3A1a1.)

(b) *Of Measurement and Size of Roofing Slate.*—Roofing slate is sold in the United States by the "square," a "square" being a sufficient number, of pieces of slate of any size to cover 100 square feet of roof, with allowance generally for a 3-inch lap. The size of the pieces of slate making up a square ranges from 7 by 9 inches to 16 by 24 inches, and the number of pieces in a square ranges from 85 to 686, according to the size of the pieces. The ordinary thickness of a piece is from $\frac{1}{8}$ to $\frac{3}{16}$ inch, and the approximate weight per square is about 650 pounds.—From "Mineral Resources of the U. S.," 1915, 2A1d.

(c) *Of Laying Cost of Roofing Slate.*—"The square is also the basis on which the cost of laying is measured. 'Eaves, hips, valleys, and cuttings against walls or dormers are measured extra; 1 foot wide by their whole length, the extra charge being made for waste material and the increased labor required in cutting and fitting. Openings less than 3 square feet are not deducted, and all cuttings around them are measured extra. Extra charges are also made for borders, figures, and any change of color of the work and for steeples, towers, and perpendicular surfaces.'"—From "Kidder's Pocket Book," 1916. P. 1499.

2K8 Current Comment

(a) "The U. S. Geological Survey in 'Stone in 1915' says: 'For several years slate has suffered from competition with artificial roofing materials, which have been aggressively advertised, and from the increasing number of factories, dwellings, schools, and other buildings that have been built with flat roofs. Some slate-producers complain that there is a general apathy on the part of slate companies in meeting these conditions; that inadequate advertising of slate is largely responsible for the inroads made by well-advertised artificial materials; and that the failure of companies to coöperate in promoting its development has allowed the slate industry to remain nearly stationary or to decline, while other competing industries have made substantial progress.'"

(b) *Graduated and Variegated Roofing.*—A decided impetus has in recent years been given the roofing slate industry through the activities of a few resourceful producers who have coöperated with some architects in procuring roofs distinctive in this country though happily to be found in abundance in Europe. There, as here, the effect desired is obtained by utilizing to the full the materials with which the quarries abound including the largest range of color and varying sizes and thicknesses. Naturally, however, the cost of production, transportation and laying increases the cost of the roof but not out of proportion to the effect desired. Notes pertaining to this kind of roofing as the "Old English Method" will be found in "Kidder's Pocket Book," 1916, page 1498.

(c) As applicable also to slate, see "Selling Stone by Sample" 2J10.

Serial No. 3

FIRE-PREVENTION AND -PROTECTION ISSUE

Section I. Fire-resistive Materials

INTRODUCTION

(Written for the Structural Service Book, Vol. I)

Considerations looking toward the safeguarding of life and health in addition to the protection of property are constantly receiving fuller attention from all agencies working for the reduction of the fire-hazard.

This is evident from the addresses and discussions at meetings and from the committee reports, code suggestions, technical letters, regulations, standards and publications of many of the organizations mentioned in this and the next two Serial Numbers, 4 and 5, of this book.

Such a tendency, corroborating the statement of Dean Pound of the Harvard Law School that "the greatest thought of this century is the transference of value from property to humanity," is also apparent in some of the work and publications of the National Government and of the states and municipalities.

The first known list of all agencies working toward improvement in structural materials and methods and toward higher ideals in the sheltering of humanity appears in the "Contents" to this book. The work of compiling this has emphasized anew the necessity for a greater coördination of all these activities and for a fuller coöperation between all forces in what we have chosen to call the field of Structural Service.

In the absence of a centralized National administrative department to control the people's building policy in all its varying phases, interest naturally centers upon those branches of the Government which perform functions related to this field. These also are listed under the "Contents."

The accomplishments of states and municipalities which manifest themselves through building, sanitary and other codes are referred to not only in this serial number, but throughout the Book, and are listed as fully as possible within the limitations of the "General Index."

As of further interest in this connection, read the addresses and discussions on "Districting, Housing and Building Regulations, National and State Codes" in the Proceedings of the nineteenth annual meeting of the National Fire Protection Association, pages 294-323 and "A National Building Policy" in *Construction* for June, July, and August, 1917. Of significance, also, is Circular No. 75 of the Bureau of Standards entitled "Safety for the Household" issued Jan. 10, 1918, which contains 126 pages of important suggestions including those on "The Fire-Hazard in the House."

CONTENTS

Having in the January and February numbers covered foundational requirements in concrete and stone, and in cement and lime of our composite building or typical structure, and having in the same issues treated of the steel and iron work and of the concrete and stonework, our progress in the erection of such a building now reaches the third of the twelve stages and brings us to the point where the enclosing walls with their facings (other than stone), the floors, partitions and some roofings may now be considered, and the skeleton of the structure be brought near completion.

These forms of construction cover a wide range of materials and devices, and to simplify the classification they will be divided as follows: March, Serial No. 3, "Fire-resistive Materials;" April, Serial No. 4, "General Building Construction;" May, Serial No. 5, "Wood," all forms and uses.

All electrical features pertaining to fire- and safety-hazards will be referred to under Serial No. 6. "Electricity," and similarly gas features will be referred to under Serial No. 7, "Gas."

MARCH, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

- 3A** U. S. Navy Department.
- 3A2** Architects and Fire-Prevention.
- 3A3** National Fire Protection Association.
- 3A4** National Board of Fire Underwriters.
- 3A6** Underwriters' Laboratories.
- 3A7** Associated Factory Mutual Fire Insurance Companies.
- 3C** Other Agencies Concerned with Fire-resistive Materials.

- 3D** Terra Cotta, Hollow Tile, and Brick.
- 3D5** Metal Lath, Gypsum, Asbestos, and Wired Glass.
- 3E1** Reports on Buildings under Fire.
- 3E2** Reports on Fire-Tests of Materials.
- 3F** Fire-Tests by U. S. Bureau of Standards.

(The Fire-Prevention and -Protection issue, with the Section on General Building Construction, will be concluded in April, Serial No. 4.)

Fire-Resistive Materials Section

3A1 Navy Department, U. S. A. State, War and Navy Building, Washington, D. C.

No division of the National Government is more concerned with the protection of metal and wood and the prevention of fire than is the Navy Department, because of its control of floating equipment. In this, especially when not in contact with land, the means to control and fight fires is self-contained and must be the utmost in availability and efficiency.

The Navy also has control over a large amount of construction on land, as well as at sea, and frequently in combination, so that its functions with respect to construction are divided.

Standards:

(a) For the use of the Government, specifications have been prepared by Boards on Uniform Specifications, representing the Treasury, War and Navy Departments. The "Specifications for Plumbing Fixtures, etc.," prepared by the Board on Uniform Plumbing Specifications, are described under 9A1.

(b) Researches and investigations in connection with materials are constantly being conducted by all the technical bureaus of the Navy, either individually or in coöperation, and at the various navy-yards. The results are not usually made public, but the conclusions drawn therefrom are utilized in the frequent revisions of the "Navy Department Specifications" relative to each material or industry affected, which are issued through the—

3A1a Bureau of Supplies and Accounts

Publications (1): "Index to Specifications Issued by the Navy Department for Naval Stores and Material" This is revised quarterly and is received by the Structural Service Department through the courtesy of the Bureau.

(2) *Navy Department Specifications:*

These are printed and issued by the Bureau of Supplies and Accounts as standards which obtain in securing estimates or having materials furnished or work done for all branches of the Navy. Copies of the Index (1), and of the specifications when in stock, may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

3A1b Bureau of Construction and Repair

3A1c Bureau of Yards and Docks

Publication: Bulletin, "Public Works of the Navy," under the cognizance of the Bureau of Yards and Docks and the Corps of Civil Engineers, U. S. Navy, issued quarterly. Described under 8A1.

Reference throughout the Structural Service Book will be found to the important work and conclusions of these two Bureaus of the Navy. The administration and organization of the Bureau of Yards and Docks, the duties of which Bureau comprise all that relates to the design and construction of public works, including all buildings for whatever purpose needed under the Navy and Marine Corps, will be found described under 8A.

3A2 Architects and Fire-Prevention

Architects and engineers should from the inception of their work maintain the closest coöperation with the forces organized to bring about a better understanding of those requirements in construction and occupancy which make for a lessening of the risk of loss in the capital invested in the insurance business.

Entirely aside from those ethical considerations, which will always seek the safety of the occupants and the protection of the structure and its surroundings, it should be borne in mind that insurance premiums are in reality a tax levied in the endeavor to stabilize the investment of capital upon which all industry depends.

It is a simple proposition that the less the loss, the less the tax; the less the coöperation at the inception, by those charged with building construction with those administering the tax, the greater the subsequent cost due to reinspection, alteration or readjustment, irrespective of eventual loss.

Therefore, besides observing all local building ordinances, the standards and other publications of the various authorities and controlling agencies hereafter described should be followed as closely as possible, and even when this be done, the local underwriters should in every case be consulted and their comment and suggestions obtained before construction is contracted for or work commenced. The Editor has the assurance of many local boards of underwriters (which, as pointed out by Mr. Woolson in his description of the National Board, have no connection therewith), and it has also been his invariable experience that these opportunities to discuss conditions before contracts are let, instead of afterward when vexatious and perhaps costly changes may be requisite to serve the best interests of the owner and of the community, are welcomed—never discouraged. (For Coöperation see 3A9c and 3G2.)

3A3 National Fire-Protection Association

Organized 1895

Secretary: Franklin H. Wentworth, 87 Milk Street, Boston.

Publications: (See pages 43, 44, for detailed list.)

Standards and literature on varied phases of building construction, fire-prevention and -protection, and on other matters of great importance and value to architects, engineers, constructionists and public-spirited citizens generally are issued as listed on pages 43, 44, under a special classified 3A3 extension index with other publications for members, prices and detailed information.

Among them are: "Standard Regulations for Fire-Protection and the Safeguarding of Hazards."

"Suggested State Laws for Regulating Fire-Hazards."

"Suggested Municipal Ordinances for Regulating Fire-Hazards," which have also been adopted by, and are the official standards of, the National Board of Fire Underwriters.

Of the above publications those of especial significance to architects and constructionists will be referred to under each industry, material, or subdivision in this and other issues of the Journal.

Many of these will be found, through use, to save much time, trouble and duplication of effort on the part of Architects and others, as well as to afford the satisfaction of having contributed toward the general adoption of standards, so valuable when measured by results obtained.

Purposes, Standards and Membership:

The National Fire-Protection Association has two functions. One is to make the "standards" under guidance of which the fire waste may be checked; the other is to edu-

cate the people in the observance of those standards and point out the grievous economic penalties for ignoring them.

The character of these standards, rules and requirements is shown by the list of publications printed on pages 43 and 44. The standards are made by the representatives of the membership organizations, included in which is the American Institute of Architects and 128 others. These representatives are men selected for expertness in one form or another of all phases of building construction or fire-prevention engineering, and serve the Association without pay. There is no public effort in the history of the nation to which there has been so freely given, over so long a period, any more of expert thought and painstaking technical investigation than to the National Fire-Protection Association.

This work of compiling and revising standards covering explosives, gases, oils, electric wiring, fire appliances and all methods of construction must continue indefinitely. It is a work for experts and commands the services of those members having not only technical education but wide, practical experience in their special callings.

These men meet throughout the year, having membership on various committees in the Association, of which there are a large number constantly at work. Those whose activities are of especial significance in connection with building construction are:

The Committee on Fire-Resistive Construction, which is composed mainly of engineers and architects with Ira H. Woolson as Chairman, some five years ago decided to establish requirements of construction suited to buildings of the greatest fire-resistance and to define a "Standard Building" applicable to any occupancy, leaving, as much as possible, the details of construction for special occupancy and special use or hazard to be determined later as modifications of these standard requirements. This resulted in the publication of "Specifications for Construction of a Standard Building" (3A3d31), which "Standard" has served as a model or framework for the application of the various standard forms of construction adopted by the Association.

The Committee later drafted recommendations for forms of construction adapted to buildings of special use, including dwelling houses, and at the Convention in 1916 submitted specifications for a structure of the executive administration type known as "Office Building." This report of the Committee has been published as "Specifications for Construction of Office Building Grade" (A) and is listed under 3A3a31a.

The Committee on Field Practice is made up of those especially qualified to pass upon details of construction and equipment and who are familiar with the necessity for the proper upkeep and maintenance of installations.

This Committee's knowledge and observations have resulted in the publication of "Field Practice" referred to frequently and listed under 3A3d1. It covers the more essential features to which especial attention should be given in order that the efficiency of installations should be maintained and conforms to the standards of the N. F. P. A. as published and promulgated by the National Board of Fire Underwriters to which references are made throughout.

The Committee on Manufacturing Risks and Special Hazards, during the recent year, gave especial attention to the correction of structural defects in existing buildings and submitted a report intended to be of practical use to persons in charge of property or the alteration of buildings. This report is illustrated and is replete with suggestions. It is entitled "Structural Defects, Suggestions for Their Elimination and Protec-

tion," listed under 3A3d 32b, also printed in the "Proceedings of the Twentieth Annual Convention, 1916."

The Committee on Protection of Openings in Walls and Partitions has promulgated regulations and recommendations for these important features of construction to which reference will elsewhere be made.

The Committee on Safety to Life will be mentioned in connection with "Exits, Stairways and Fire Escapes," Serial No. 4.

Many other Committees exist whose work, all of it important, concerns one phase or another of protection equipment and installation.

The Association meets annually in a three days' convention, at which the report of each committee working during the year on the various standards is presented by its experts and discussed by the convention before adoption. The progress of the nation in science, invention and the industrial arts makes constant revision of these standards imperative. The Association for over twenty years has been compiling and revising these standards, which are now the recognized national guide and authority, and are officially adopted by the National Board of Fire Underwriters and all other organizations interested in fire-protection or -prevention.

The proceedings of the annual convention are issued in printed form so that all members may study the reports and the discussions thereon at their leisure.

The Quarterly Magazine of the Association is unique in its special articles on fire-hazards, fire-protection and -prevention, and the economic effects of the fire-waste, and the monthly News Letter is of decided interest and keeps members posted on the latest developments in fire-protection engineering and building materials and construction.

Special studies are made of the effect of fire on concrete and other buildings of fire-resistive construction. Bulletins are regularly issued and, during each year, many individual papers and reports on specific topics are sent to members, besides copies of all the Association's standards as soon as they are completed and published.

The Association's membership is composed of architects, builders, merchants, manufacturers, warehousemen, lumbermen, engineers, fire-marshals, fire-wardens, fire-chiefs, electricians, credit men, bankers, insurance agents and inspectors, boards of trade, chambers of commerce, public libraries and many other organizations, individuals, firms and corporations. Any individual, firm, corporation or society is eligible to membership.

[EDITOR'S NOTE.—It is with considerable satisfaction that attention is called to the fact that for two years past a member of the Institute, Mr. Robert D. Kohn, was President of the N. F. P. A., and that the present Treasurer of the Institute, Mr. D. Everett Waid, is a Vice-President—but, with regret, attention is drawn to the further fact that but fifty architects are members of the Association.]

3A4 The National Board of Fire Underwriters

Organized 1866

General Manager: W. E. Mallalieu, 76 William St., New York City.

Publications: (See pages 44, 45, for detailed list.)

Suggested regulations covering the installation of hazardous and protective devices, model building regulations and ordinances, and special reports on various subjects prepared by the engineers of the Board. A list of the publications distributed by the Board will be found on pages 44, 45, under a special classified 3A4 extension index.

The National Board of Fire Underwriters, an organization composed of 133 of the principal stock fire insurance companies, is supported by a pro rata tax upon the members, and has been in existence fifty-one years.

STRUCTURAL SERVICE BOOK

Organized in the troublous period following the Civil War, when unlimited rate competition and a rapidly rising fire ratio were threatening the solvency of American fire insurance, it sought to restore stability through a rigorous control of rates. At first these efforts met with considerable success, and to them is largely due the fact that so many companies were able to survive the double blow of the Chicago and Boston conflagrations in 1871 and 1872.

Difficulties arose, however, which made it necessary to abandon rate-control. This was done in 1877, since which date the National Board has exercised no jurisdiction or supervision of the question of rates, that power being entirely in the hands of local fire underwriters' associations, each having jurisdiction over certain specified areas. (See 3A5.)

Eleven years after its abandonment of rate-control, the National Board likewise ceased to regulate brokerage commissions. Following this final relinquishment of legislative power, the organization began a new phase in its history and rapidly developed into the great service institution, to both its members and the public, which characterizes its beneficent operations today.

In a sense, its name has become a misnomer, since it no longer exercises the functions of an underwriter. It has really become an investigative, standardizing, and distributing organization, dealing with the broad principles of underwriting and fire-protection. In this work it cooperates the best technically trained service it can secure with the wide practical experience of its members.

Its activities are conducted through standing committees under supervision of the Executive Committee and the direction of the General Manager. Most of these committees employ skilled experts who devote their entire time to work planned by the committees. The more important committees are the following:

The Committee on Laws makes a special study of the legal, legislative, and administrative phases of the relations of fire insurance to the public.

The Committee on Incendiarism and Arson, as its name implies, is organized to combat these most subtle and heinous of crimes which frequently destroy human life as well as property.

The Committee on Statistics and Origin of Fires collects and classifies fire-loss figures from fire-department records and other sources of public information. It critically studies this data and makes recommendations based upon the conclusions obtained.

The Committee on Fire-Prevention has for many years been one of the country's strongest influences for lessening the public fire-hazard. This Committee, at large expense, maintains a staff of field engineers under the direction of a Chief Engineer, Mr. George W. Booth, who are constantly engaged in inspecting the water-supply, fire-department equipment and efficiency, and fire-alarm system in the larger cities of the United States. Particular attention is devoted to the proper protection of congested valued districts and the removal of conflagration hazards.

It issues detailed reports covering these inspections and recommendations based thereon. These reports are furnished to members of the Board and to the city officials, but are not for general distribution. The Committee's recommendations have lead to extensive improvements in many cities.

The Committee on Construction of Buildings devotes its energies to encourage better building construction, and thereby endeavors to aid in reducing the enormous annual fire-waste. As the activities of this Committee are of more direct interest to the architect than the others, they are treated here in greater detail.

The most important work accomplished by this Committee was the drafting of a Model Building Code intended as a guide for the use of city commissions entrusted with the preparation of new building ordinances or the revision of old ones. (See 3A4d1.)

This Code was first issued in 1905. It has passed through four editions, and over 25,000 copies have been distributed. The last revision—that of 1915—was very radical, the form and text being completely changed. The volume is thoroughly up-to-date, and its engineering and fire-protection features represent the best current practice. The Code is furnished, without charge, to building commissions, and upon application is sent to architects, engineers and builders who desire to use it as a guide in safe construction. The Code has been adopted as a supplementary textbook in the engineering and architectural courses of several universities and technical schools.

The last revision was made by Ira H. Woolson, Consulting Engineer to the Committee, and formerly a professor in engineering at Columbia University, who has been engaged to prepare the Committee's publications and take charge of its rapidly increasing work of promulgating building construction standards and fire-protection information.

The Committee's office has become a clearing-house for distribution of such data. It renders a vast amount of gratuitous consultation service to cities which are revising their building codes, and results show that it is wielding a strong influence in eradicating pernicious building customs which have been such prolific contributors to our enormous and senseless annual fire-loss. The Code is being used as a guide by many cities in the revision of their building ordinances, and not infrequently it is copied practically as printed.

The Committee also distributes "A Suggested Building Ordinance for Small Towns and Villages" which was prepared jointly with a committee of the National Fire Protection Association. (See 3A4d2.)

The latest publication on safe construction issued by the Committee is entitled "Dwelling Houses," which deals specifically with the fire-hazards of this class of buildings and is full of suggestions for remedying such defects. Copies of this were furnished the Institute's Committee on Fire-Prevention for distribution to all members of the Institute. (See 3A4d3.)

Considering that the annual dwelling house property loss in the United States for the year 1915 (the latest figures available) was in excess of \$40,000,000, and that it was accompanied by a large loss of life, the need of such a publication is apparent. The majority of dwellings are located outside the jurisdiction of municipal building laws, and as there are at present but two or three states which exercise authority over building construction, most dwellings are erected without any supervision whatever.

The Committee on Lighting, Heating, and Engineering Standards is the special intermediary between the Executive Committee and the Underwriters' Laboratories of the National Board of Fire Underwriters. The function of the Laboratories is to test and classify materials, constructions and devices according to their fire-resistive qualities, and to assure that the quality of the manufactured product is maintained equal to that of the sample tested. Details of the operations of the Laboratories are given elsewhere in the Journal.

The Committee on Clauses and Forms studies the intricate structure and phraseology of fire insurance policies, and offers proposals for betterment, but they are not mandatory upon local underwriting organizations.

The Committee on Adjustments operates principally as

a stabilizer when the relations between insurance companies and the assured have suddenly been thrown into an unbalanced or chaotic condition, as by a conflagration.

The *Actuarial Bureau* is the newest activity of the National Board, having been put in operation in 1915. It receives daily reports of practically all fire-losses paid by the insurance companies in the United States, averaging over two thousand (2,000) per day, and has a large force of tabulators, sorting, classifying and recording the vast amount of data contained in the reports.

Figures are compiled showing the number of fires and loss in each class of occupancy due to the various causes of fire. The accumulated figures are carefully studied, their meaning interpreted and conclusions drawn as to the relative hazard of construction, exposure and occupancy.

These statistics are the first really reliable data ever collected over the whole country upon this extremely important subject. They include the number of fires and insurance losses paid, segregated in accordance with the various causes, under each standard class of construction, whether protected or unprotected by water works and fire departments.

The recent history of the National Board has been one of rapidly increasing influence as a public service institution. It will be noted that most of its work is distinctly educational in character and of direct public benefit. It inaugurated and has vigorously sustained, through close and cordial relations with the National Fire Protection Association, the fire-prevention movement which is now finding expression throughout the country, both in the matter of public improvements and popular education.

The above summary indicates briefly the functions and scope of this great organization which, although it possesses no legislative powers and is sustained at private expense, is unquestionably one of the greatest constructive forces in the United States today.

IRA H. WOOLSON

Consulting Engineer to Committee on Construction of Buildings.

3A5 Local Underwriters' Associations

The local boards of fire underwriters, or fire insurance exchanges, are composed of the insurance companies or their officers or agents; some of the officers may also represent their companies in the National Board with which the local bodies have otherwise no official connection whatever. Each such organization is a separate and distinct association, complete within itself, having its own officers and different departments dealing with the special hazards which affect fire-insurance losses and other matters relating to the actual business of underwriting within its own prescribed territory.

They endeavor to establish equitable rates to cover the hazards; use their influence to create efficient private and public fire-protection; and encourage the enactment of proper building laws. It is their purpose and desire to coöperate with all local municipal and other authorities and with architects, owners and constructors of buildings to whom will be distributed the Standards of the National Board and other publications upon request and in the interest of their general observance. Some associations issue publications of their own.

3A6 Underwriters' Laboratories

Chartered by the State of Illinois, 1901

President: William H. Merrill, 207 E. Ohio St., Chicago.

Publications:

- (a) Organization, Purpose and Methods, 1916.
- (b) List of Inspected Mechanical Appliances.

- (c) List of Inspected Electrical Appliances.
 - (d) List of Appliances Inspected for Accident Hazard.
 - (e) Electrical Data.
 - (f) Standard on Rubber-covered Wires and Cords.
 - (g) Procedure for Inspections at Factories and Labeling Rubber-lined Fire-Hose.
 - (h) Standard for Counterbalanced Elevator Doors.
 - (j) Standard on Cabinets and Cutout Boxes.
 - (k) Standard (Tentative) for the Construction and Installation of Materials for Lightning Rod Equipments.
- Other Standards are now in mimeograph form.
[NOTE: (a) sent upon request; (b), (c), (d), and (e) revised semi-annually, sent upon request; (f) to (k) separate publications, supplied at \$1 per copy.]

The work of the Underwriters' Laboratories was mentioned in the January Journal under 1B2a, and will be found more fully described on page 141 of the Industrial Section. See also 3E3b for coöperation of the Laboratories in fire-tests on building columns with the U. S. Bureau of Standards and the Factory Mutual Laboratories.

The work of the Laboratories with respect to accident-hazards will be mentioned under Serial No. 5 (5G3j), and with respect to electrical matters under Serial No. 6 throughout that issue.

3A7 Inspection Department; Associated Factory Mutual Fire Insurance Companies

Organized 1886

Secretary: C. H. Phinney, Engineer, and Asst. Sec'y.
H. O. Lacount, 31 Milk Street, Boston, Mass.

Publications: (See page 45.)

- "Approved Fire-Protection Appliances."
- "Approved Electrical Fittings."

These are issued semi-annually, in April and October, and contain results of the tests and examinations of the various appliances which are, by the Mutual Companies, used as a basis for approvals.

Pamphlets.
Leaflets.

All these publications will be found listed under a special numerical index on page 45, and will be referred to in this and other issues of the Journal under various subdivisions or industries; those pertaining to lumber and wood construction in Serial No. 5, and to electricity in Serial No. 6.

The Associated Factory Mutual Fire Insurance Companies grew from the idea of a New England manufacturer who started the system in 1835. Other manufacturers became interested and it was agreed to share losses in their factory on a mutual plan. They studied the causes of fire, profited by each others' experiences, and through such coöperation reduced the cost of their insurance materially. This led to the formation of a mutual fire insurance company and later similar companies were organized which joined in forming the present great system, that now oversees the protection and provides the insurance for a large part of the better manufacturing properties in the United States and Canada, aggregating over three and one quarter billion dollars in value. Insurance is distributed among the following, comprising the Associated Factory Mutual Fire Insurance Companies.

1. Manufacturers Mutual Fire Insurance Co., Providence.
2. Rhode Island Mutual Fire Insurance Co., Providence.
3. Boston Manufacturers Mutual Fire Insurance Co., Boston.
4. Firemen's Mutual Insurance Co., Providence.
5. State Mutual Fire Insurance Co., Providence.
6. Worcester Manufacturers Mutual Insurance Co., Worcester.
7. Arkwright Mutual Fire Insurance Co., Boston.
8. Blackstone Mutual Fire Insurance Co., Providence.
9. Fall River Manufacturers Mutual Insurance Co., Fall River.
10. Mechanics Mutual Fire Insurance Co., Providence.
11. What Cheer Mutual Fire Insurance Co., Providence.
12. Enterprise Mutual Fire Insurance Co., Providence.

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13. Merchants Mutual Fire Insurance Co., Providence.
14. Hope Mutual Fire Insurance Co., Providence.
15. Cotton and Woolen Manufacturers Mutual Insurance Co., Boston.
16. American Mutual Fire Insurance Co., Providence.
17. Philadelphia Manufacturers Mutual Fire Insurance Co., Philadelphia.
18. Rubber Manufacturers Mutual Insurance Co., Boston.
19. Paper Mill Mutual Insurance Co., Boston.

The Associated Factory Mutual Fire Insurance Companies established in 1886, an Inspection Department, or Engineering Bureau, to take over the work of inspection of all the Mutual risks, the making of plans and appraisals of the properties insured, and the engineering work along all lines of fire-protection engineering previously done by the individual companies for the information of themselves and the Mutual members. Since 1896 the Bureau has also been responsible for the adjustment of all losses.

The work in fire-protection engineering soon called for the testing of fire appliances, and in 1890 a laboratory was established under the direction of the Inspection Department, as mentioned under 3A8.

A large amount of pioneer work in fire-protection has been done in the Inspection Department and Laboratories, notably Fire-Stream Tables prepared from data obtained in an extensive series of tests by John R. Freeman; improved building construction in the slow-burning or mill-construction type of factory building and the development of the private fire-protective equipment, involving particularly the design, construction and installation of the steam, rotary and centrifugal fire-pumps and of automatic sprinklers and dry-pipe valves. At the present time about 1,000 automatic sprinkler joints are on test there under daily observation. A large amount of work has also been done on rubber compounds, principally as applied to the linings of fire-hose and valves in Underwriter fire-pumps. During the past several years the subject of dry rot of factory timber has been very thoroughly investigated, resulting not only in a suggested specification for long-leaf pine for use in Mutual risks, but also a treatment of timber to prevent or arrest decay. This important piece of work will be referred to in the Journal under Serial No. 5, "Wood," and later in this section.

There has recently been completed an exhaustive investigation on the subject of fire-hazards of cutting oil, in which a large percentage of kerosene frequently is used.

When the resources of the Laboratory have been exhausted on any particular device, more can be learned through service in the field, and this field experience is being brought to the Laboratories continuously by the inspectors of the Inspection Bureau. Again, a large amount of information can frequently be obtained from the investigation of fires, which is generally made in connection with the adjusting of losses, and this first-hand, valuable data is immediately available to the Laboratories. These features are believed to be real assets of the Laboratories, and assist materially in reaching a correct conclusion, which finds application throughout a large and increasing field. Advice on all subjects having to do with the prevention of fires and protection against fires is freely given property-owners carrying Mutual insurance.

3A8 Factory Mutual Laboratories Established
1890
Engineer: W. O. Teague, 31 Milk Street, Boston, Mass.

This laboratory, known as the Factory Mutual Laboratories, was established under the direction of the Inspection Department, as above noted. It issues no publications, as these emanate from the Inspection Department. From time to time, hazards incident to manufacturing

processes have been investigated in the Laboratories, and the work has greatly increased until now they occupy the central plant at the above address, and in addition there is a hydraulic station at Lowell, Mass., and a fire-test house at North Woburn, Mass.

The Laboratory is designed primarily for the use of mill-owners whose properties are insured in the Associated Factory Mutual Fire Insurance Companies. In general only such devices and subjects are investigated as will be of interest to Mutual members, and there is no charge for this service, either to the parties submitting the appliances or to the members. See also 3E3b.

3A9 American Institute of Architects

(For reference see 1A8)

Of the various committees of the Institute the four most intimately concerned with building construction, and hence with fire-prevention matters, are as follows:

3A9a Committee on Fire-Prevention

In the past the Committee has been mainly active representing the architects at the conventions of the National Fire-Protection Association and particularly active in the committee work of that Association. Under the past chairmanship of Mr. Julius Franke of New York, it distributed to the architects throughout the country valuable information on the subject of fire-protection. The new Committee just organized has not yet had time to plan out its campaign. The Chairman realizes that the enlightenment of the average architect on the subject of fire-protective design is a mighty difficult job. A plan is being considered at present whereby the Committee, in cooperation with other organizations, might publish a series of structural-service sheets or details showing clearly the methods of fire-resistant construction in all types of buildings and in all parts of buildings.

ROBERT D. KOHN, *Chairman.*
Institute Committee on Fire-Prevention.

3A9b Committee on Basic Building Code

3A9c Committee on Materials and Methods

The reports of these Committees, as presented to the last Convention and printed in the "Proceedings" of the Institute, will be found of much interest structurally. These Committees will, of course, cooperate in all ways possible with the Committee on Fire-Prevention and provide valuable assistance to the Structural Service Department. The Chairman of the latter Committee has already addressed all members of subcommittees on the subjects covered and to be treated in this Department.

3A9d Committee on Contracts and Specifications

See "Fire Insurance" (4H) for practice recommended by the Institute in respect to this matter.

3A9e New York Chapter, American Institute of Architects

Organized 1867

Secretary: Stowe Phelps, 20 West 43d St., New York City.

"Realizing the vital relation of the architect's work to the causes which produce the enormous annual economic waste and loss of life due to fire, the New York Chapter, some six or seven years ago, formed a Fire-Prevention

Committee. This Committee coöperates with the New York Board of Fire Underwriters.

"The former Chairman of the Committee, Mr. Julius Franke, working with the assistance of Mr. F. J. T. Stewart of the Underwriters, prepared and sent out two years ago a very valuable booklet of general information for architects with regard to the important points to be considered in the design of buildings from the point of view of fire-prevention and low insurance rates. (See 4B2e1.)

"Since then the Committee on Fire-Prevention has been sending out to the Chapter members such of the fire reports of the Underwriters as deal with buildings in which obvious and curable defects of design have contributed toward the fire-loss. These reports are printed by the Underwriters and submitted to the Chairman of the Committee for his opinion as to whether or not they will be of value to the architects. For reports of value, the Chapter pays part of the cost of printing and mailing."

*J. A. F. CARDIFF, *Chairman*,
Fire-Prevention Committee, New York Chapter A. I. A.

3A9f *Joint Committee on City Departments*

"The New York Chapter also has one other field of coöperation with the Underwriters through the 'Joint Committee on City Departments.' In this Committee the delegates of the Chapter, the Underwriters, the building trades and the engineers come together to discuss any questions affecting the building interests of the city. This Committee is very active in the furtherance of fire-protection ordinances and laws, and in its opposition to amendments that are liable to lower the standards of fire-protection work." *J. A. F. CARDIFF, *Chairman*,
Fire-Prevention Committee, New York Chapter A. I. A.

*Deceased.

[EDITOR'S NOTE: Other Chapters are invited to communicate data on any other similar local activities.]

3A10 *Reports of Other Committees*

(a) The Report of a Special Committee of the American Institute of Architects relative to the work of the

3C Other Agencies Concerned with Fire-Resistive Materials

In addition to the foregoing governmental departments and organizations interested in fire-prevention, fire-protection and fire-fighting, the following are known nationally for their interest, through investigation, production or manufacture of materials used in fire-resistive construction, with particular reference to burnt clay, which will be treated herein as a product and to metal lath, metal appliances, gypsum and asbestos, which will be referred to as accessories. The latter will again be referred to as products in other serial numbers.

In later serial numbers, also, burnt-clay products other than brick and terra-cotta will be referred to in connection with other industries, and wired glass, as a product, will be more fully treated in Serials 4 and 12.

It will be recalled that concrete construction and structural steel have been treated in Serial No. 1, and stone and slate in Serial No. 2.

3C1 *American Ceramic Society, Inc.*

Edward Orton, Jr., Department Ceramic Engineering,
Ohio State University, Columbus, Ohio.

Publications:

(a) "The Transactions" in seventeen volumes, varying in price from \$4 each, in paper, to \$6.25 in cloth.

Underwriters' Laboratories will be published in Section II, April issue.

(b) Reference will also be made in same issue to the Committee on Fire-prevention in the American Society of Mechanical Engineers.

3B1 *Fire Marshals' Association of North America.* Pres.: L. T. Hussey, Topeka, Kans.

Publications:

Proceedings of the Convention, issued annually. In this volume papers and addresses on subjects affecting state building regulations, laws authorizing state fire marshals to condemn and remove buildings that are fire-hazards, and others of similar purport, with the discussions and resolutions, are printed.

Its membership consists of the Fire Marshal, Fire Commissioners and their deputies of each state, who are charged with the duties defined as those of the State Fire Marshal of Massachusetts in the original law of the state. Such official may delegate as his representative at any meeting or on any committee any person officially connected with his department.

3B2 *International Association of Fire Engineers*

Organized 1873 as the National Association of Fire Chiefs; name changed in 1894

Secretary: Chief James McFall, Roanoke, Va.

Holds annual meeting at which committees report, papers are read and addresses made which are constantly being printed as valuable recommendations or contributions toward the improvement of fire-fighting apparatus and methods.

As has been said in the "American-La France Bulletin," "Probably no other body of men have devoted themselves so silently, watchfully and constantly to the welfare of the people, served progress so faithfully, or have in forty-four years rendered such a mighty service in the saving of life and property as the members of this organization."

3B3 *Other organizations interested in fire-prevention matters* are the seven listed under 12L, from 15 to 21 inclusive.

- (b) "A Bibliography of Clays and the Ceramic Arts," Dr. John C. Branner, 1906. Contains 6,027 titles of works on ceramic subjects. Cloth, \$2.
- (c) The collected writings of Dr. Herman August Seger, Vol. I, p. 552, cloth, \$7.50; contains:
 - (1) Treatises of a General Scientific Nature.
 - (2) Essays relating to Brick and Terra Cotta, Earthenware and Stoneware and Refractory Wares.
- (d) Vol. II, p. 605, cloth \$7.50; contains:
 - (1) Essays on White Ware and Porcelain.
 - (2) Travels, Letters and Polemics.
 - (3) Uncompleted works and extracts from the archives of the Royal Porcelain Factory.
- (e) List of papers and discussions contained in "The Transactions," —furnished upon request.

Its work has been confined to discussions of the many little-understood phases of the ceramic industry and has not yet reached the stage of definite specifications. Holds an annual meeting from which the resulting contributions to the development of the whole clay-working industry, published in "The Transactions," are to be considered as of great import.

3C2 *Educational Research Work* (See also 1B3a)

As mentioned in Serial No. 1, the colleges and universities of the country are performing distinctive ser-

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vice in the development of materials and methods pertaining to the structural industries. Many of those listed maintain departments or branches devoted to investigation and study in clays and clay-working. The University of Illinois, on December 6 and 7, 1916, formally dedicated its recently completed Ceramic Engineering Building. Among others contributing to the development of the ceramic arts are Ohio State University, Department of Ceramic Engineering, Iowa State College, Rutgers College, and the New York State School of Clay-working and Ceramics.

(a) University of Illinois Engineering Experiment Station, Urbana, Ill. Established 1903 to carry on investigations in engineering and to study problems of importance to professional engineers and to manufacturing, railway, mining, constructional, and industrial interests of the state.

Publications:

(1) Circulars and (2) Bulletins on important phases of problems affecting architects as well as engineers.

Each bulletin is subject to a free initial distribution, on the basis of existing mailing-lists. It is also placed on sale with authorized agencies, both in this country and abroad. A limited number of copies is available for free distribution upon request, after the initial distribution. As the supply approaches exhaustion, it is placed upon a reserve list and withdrawn from free distribution.

A name is placed upon the regular mailing-lists of the Station at the request of the person, institution or company so desiring. These lists are divided into six classes: All-Bulletin, Structural, Electrical, Fuel, Railway, and Notification. In requesting a name placed on the list state class of bulletins desired.

3C3 *The Refractories Manufacturers' Association*

Secretary: Frederick W. Donahoe, 220 S. Michigan Ave., Chicago.

Issues no publications—other than (a) and (b)—that would interest anyone not directly engaged in the manufacture of fire-brick and similar refractories.

Objects are to promote a closer relation between the manufacturer, dealer and consumer of refractories of all kinds; to improve in every way the product of its members and to standardize, as far as possible, the various designs and shapes manufactured.

Holds an annual meeting, and, like so many others mentioned herein, maintains relations with the U. S. Bureau of Standards and other agencies working to improve the nature, understanding and use of structural materials.

Standards:

Has committees to work with the American Society for Testing Materials, with the Refractories Committee of the American Gas Institute, and on Standardization of Fire Clay, on Silica, and on Government Adoption of Standards.

As the beginning of a series of charts, issues two, which are of Institute standard size, entitled:

- (a) "Standard 9 inch and 9 inch Series Brick Shapes Adopted by The Refractories Manufacturers' Association, July 29, 1913."
- (b) "Tables Showing the Number of Brick Required to Turn Various Circles, the Brick Being of Standards Adopted by the R. M. A."

3C4 *National Terra Cotta Society*

1 Madison Avenue, New York

Founded January 1, 1912

Publications:

- (a) "Architectural Terra Cotta, Standard Construction." July, 1914. A book of construction drawings (70 plates) showing the most approved form of terra cotta construction for cornices, friezes, balustrades, etc., with anchorage irons and detailed notes, complete.

- (b) Architectural Terra Cotta Brochure Series.

Vol. 1. "The School."

Illustrated by photographs of many modern school buildings, erected entirely or in part of terra cotta.

- (c) Vol. II. "The Theatre."

Illustrated by many photographs of terra cotta theatre buildings.

- (d) "Store-fronts in Terra Cotta."

Illustrating and describing the appropriate use of architectural terra cotta for the small store-front.

- (a) Free to architects—\$5 to general public. Others upon request to qualified inquirers.

Objects:

To encourage the production of the best materials and the maintenance of high and uniform standards of work; to spread the knowledge of the many advantageous qualities of good architectural terra cotta by widely advocating its merits; to cooperate in the investigation and study of the more important technical and other problems of the business; to advance mutual business interests in every legal and proper way without in any manner, directly or indirectly, agreeing to maintain prices or suppress competition; to promote a feeling of confidence and friendship among the members, so as to secure the benefits of the several objects above set forth.

Standards: See publication (a).

3C5 *The American Face Brick Association*

Secretary: R. D. T. Hallowell, Fulton Building, Pittsburgh, Pa.

Issues no publications dealing with technical subjects. Membership is composed of manufacturers and distributors of facing bricks of all kinds throughout the country.

Its object is to promote the interests of its members, to conserve the resources and increase the efficiency of the entire face-brick industry. Holds a meeting annually, at the last of which, in December, 1916, two important policies in modern trade development were adopted, namely: Uniform Cost-Finding and the Open Price-Plan.

3C6 *The National Brick Manufacturers' Association*

Organized 1886

Secretary: Theodore A. Randall, Indianapolis, Ind.

Publications:

(a) The Convention Proceedings, other transactions and reports of committees are published in full in *The Clay Worker*, the official organ of the Association.

Is distinctly an educational organization, formed to relieve the clay trade of the "rule-of-thumb" methods which formerly characterized it. Its purpose is also to promote the interests of the makers and users of clay products.

Standards:

(b) Has a committee on technical investigations and holds a convention annually, at one of which, in 1893, standards were adopted for the sizes of bricks. These were reaffirmed in 1899 and still obtain. See Standards (3D3c).

3C7 *National Building Brick Bureau, Inc.*

Secretary-Manager: Theo. A. Randall, 211 Hudson St., Indianapolis, Ind.

Publications:

Pamphlets and reprints, entitled "Build with Brick," and others.

Its chief purpose is to advocate the advantages and eventual economy of brick and substantial building construction and to encourage a greater use of brick in structural work of all kinds. Holds an annual meeting.

3C8 Building Brick Association of America
Secretary: H. J. Lee, 40 W. 32d St., New York.

Organized six or seven years ago for the purpose of providing publicity for the brick business and was supported by brick manufacturers. A series of competitions were held through the medium of the *Brickbuilder*, and over one thousand plans were secured for brick houses. These were divided into three groups and published in three books, entitled:

- (a) "One Hundred Bungalows." 50 cents.
- (b) "A House of Brick of Moderate Cost." 50 cents.
- (c) "A House of Brick for \$10,000." 25 cents.

In addition to these a large amount of general literature was published under the following titles:

- (d) "The Beauty of a Brick House." 5 cents.
- (e) "The Maintenance of a Brick House." 5 cents.
- (f) "The Brick House Safe from Fire." 5 cents.
- (g) "Brick or Frame: Which?" 5 cents.
- (h) "A Revolution in Building Materials." 5 cents.
- (j) "The Cost of a House—a Comparison between Brick, Wood, Cement and Hollow Block Construction," J. Parker B. Fiske. 10 cents.

Support was withdrawn to such an extent that this Association is now in the process of liquidation. In a sense it laid the foundation for the American Face Brick Association, which has since been formed and is taking up some of the activities of the former.

[NOTE.—A limited supply of the above publications remain, and copies may be had at the price given upon application to the Secretary.]

3C9 National Paving Brick Manufacturers' Association

Secretary: Will P. Blair, Engineers Building, Cleveland, Ohio.

Publications:

- (a) "Dependable Highways," monthly, \$1 a year.

Purposes:

Dissemination among its membership of technical knowledge relating to the manufacture of their product; to bring to the attention of the public the merits of vitrified brick as a paving material; to influence to the greatest possible extent the proper construction of brick streets; furnishing faithfully information regarding brick and other materials, and comparative values as pavements.

Standards:

(b) Specifications for the Construction of Vitrified Brick Street Pavements and Country Roads (furnished upon request), containing:

- (1) Green Concrete Foundation,
- (2) Sand-Cement Superfoundation,
- (3) Sand-Cushion Type.

The preparation of these specifications is worthy of especial comment because of the evidence given that an organization expends effort and energy upon the development of the proper use of the material with which it is concerned and not alone upon the improvement of the material itself.

3D Terra Cotta, Hollow Tile and Brick

(Pottery and soil-pipe later under Plumbing; also wall, floor and roof tile under Serial No. 11.)

The total value of all clay products marketed in 1915 was \$163,120,232, included in which it is interesting to

Serial No. 3

3C10 Hollow Building Tile Manufacturers' Association of America.

(Information not obtainable.)

3C11 The Associated Metal Lath Manufacturers. Publicity Bureau, Swetland Building, Cleveland, Ohio. Zenas W. Carter, *Commissioner:*

Publications:

- (a) "Metal Lath Hand Book." Copyrighted 1915. Bound in stiff cloth with 128 pages of text, detail drawings, and other illustrations, together with notes on acoustics, specifications for plastering and other information. Includes results of tests and makes recommendations for the best methods of using metal lath in building construction.

To obtain, and for outline of contents see Industrial Section pages 162-167. (See, also, 11D6h and m.)

Purpose:

To standardize the manufacture, use and sale of metal lath, so that the architect may be familiar with the grade, weight and type to specify for every kind of work, the contractor may know definitely what he must figure on, and the dealer will best know what materials to carry in stock. Has carried out fire-tests in the East and West to determine the value of metal-lath construction in comparison with other materials for the same purpose, and has conscientiously endeavored to formulate the standard construction drawings and specifications for the use of metal lath published in "Hand Book" (a).

Elaborate tests of stucco and metal lath are now being made by the Bureau of Standards in which the Association is coöperating. (See 3E3g.) Progress report will soon be published of this and also of tests for soundproofing partitions and walls which are now being made at one of the great universities for this Association. (11D6c and d.)

In reviewing its work less than two years ago, the Association saw that, while it was accomplishing a great good for the metal-lath industry, the vital need was to have immediate and reliable information regarding the prices quoted on metal lath, and the open-price plan was thereupon adopted.

Each member notifies the office of the Association of any change in his quotations, and these are promptly bulletined to the other members.

This simple, fair and right exchange of true market information has cured the cancer of distrust, promoted intelligent competition and put the metal-lath industry on a higher plane.

For list of component companies, for detail drawings and other information on the use of metal lath see Industrial Section, pages 162 to 167, inclusive.

3C12 Gypsum Industries Association

Reference under 11A18, 11C1 and 11D6m.

3C13 Asbestos Manufacturing Associations

Reference under 10A13 and 11A20.

3C14 National Glass Distributors Association

Reference under 12A8 and 12F1a.

note that "common" bricks figured to the quantity of seven billion one hundred forty-six and a half million.

Brick and tile continue to form approximately four fifths and pottery one fifth of the total, though the pot-

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tery products have been gradually increasing of late years.

The most prominent features in the industries were (1) the large increase in production and the even larger increase in value of common brick in Cook County, Ill. The production in 1915 (739,173,000 brick) made it the rival of the New York portion of the Hudson River region, the output of Cook County being less in quantity by only 2,395,000 brick and greater in value by more than \$1,000,000; (2) the large increase in production and value of fire-brick; (3) the increase in value of front-brick; (4) the large increase in value of clay products in Illinois and Pennsylvania; (5) the large decrease in value of sewer-pipe; and (6) the small increase in average price per thousand of common brick and the decrease in average price of other varieties of brick.

Clay products, except the highest grade, are made principally for local consumption, every state being a producer of clay wares, their low value preventing transportation for any considerable distances. Hence none but the highest grades of ware, principally pottery, are imported, and the European war has had little direct effect on the brick and tile industries. (Notes from Clay-Working Industries and Building Operations in the Larger Cities [3D1c].)

3D1 Information Obtainable

- (a) The U. S. Geological Survey has issued a great many pamphlets and bulletins (2A1d and g) dealing with clay resources and various phases of the clay-working industry. Specific information will be furnished by the Journal or complete catalogue of all publications may be obtained as noted under 2A1.
- (b) See, also, chapters on "The Clay-Working Industries" in "Mineral Resources of the U. S." (2A1c) in which all phases are treated and complete statistics given annually.
- (c) The separate chapter for 1915 (2A1d) published December 22, 1916, is available and is entitled "Clay-Working Industries and Building Operations in the Larger Cities"—46 pp. of valuable statistics.
- (cc) The U. S. Bureau of Mines (2A2) in its work on the technology of clays, has issued Bulletin 53, "Mining and Treatment of Feldspar and Kaolin in the Southern Appalachian Region," and Bulletin 92, "Feldspars of the New England and Northern Appalachian States," and Technical Paper 99, "Probable Effect of the War in Europe on the Ceramic Industries of the United States."
- (d) In the "Annual Report of the Chief of Ordnance, Watertown Arsenal" (1B1b) will often be found results of tests on clay products.
See also "Progress and Current Activities" (3D4) for tests by Bureau of Standards and others on clay products.
- (e) See "Report of Committee C3 on Standard Specifications for Brick: I, Building Brick, II, Paving Brick." (The latter adopted as a standard), in "Proceedings" A. S. T. M. (1A4), Vols. XIII, XIV and XV, containing results of tests and other data and suggestions concerning building brick.
- (f) "Practical Methods for Testing Refractory Fire-Brick," C. E. Nesbit and M. L. Bell. Pp. 349-378 "Proceedings" A. S. T. M., Vol. XVI, pt. 11.
- (g) See American Ceramic Society for list of informative publications (3C1), (b), (c) and (d). Use (e) as finder for valuable papers and discussions published annually in The Transactions (a).
- (h) "Tests of Brick Columns and Terra Cotta Block Columns," A. N. Talbot and D. A. Abrams. 1909. 25 cents. University of Illinois Engineering Experiment Station (3C2a2); also "An Investigation of built-up columns under load," A. N. Talbot and H. F. Moore. 1911. 35 cts.
- (j) Journal of the Society of Constructors of Federal Buildings (2A4a).
 - (1) "The Manufacture of Vitrified Brick," C. B. Sullivan. November, 1914.
 - (2) "Rough-Texture Brick: A Query," J. A. Sutherland. May, 1916.
 - (3) "Architectural Terra Cotta," Thos. F. Armstrong. March, 1916.
- (k) "Notes on the Compressive Resistance of Fire-Stone, Brick Piers Hydraulic Cements, Mortars and Concretes, Gen. Q. A. Gilmore.
- (l) "Wall Construction" being Chapter XX of "Fire-Prevention and Fire-Protection" by Joseph Kendall Freitag, treats of ornamental terra cotta, with many construction details and notes, and of structural terra-cotta walls and brickwork.

- (m) See "Kidder's Pocket Book:"
 - (1) "Data on Bricks and Brickwork," pp. 1454-1462.
 - (2) "Terra Cotta, Hollow Tile and Brick" (see Index to Kidder's).
- (n) For brick construction and data see "Trautwine's Civil Engineer's Handbook."
- (o) See "Building Construction and Superintendence," F. E. Kidder. Part 1, "Masons' Work."
 - (1) "Bricks and Brickwork," Chapter VII.
 - (2) "Architectural Terra Cotta, Thomas Nolan. Chapter VIII.
 - (3) "Form of Specifications (for all parts of a building) Including Architectural Terra Cotta and Brickwork," Chapter XIII.
- (p) See "The Building Estimator's Reference Book," Frank R. Walker. Sections on Terra Cotta, Hollow Tile and Brickwork.
- (q) See "Building Trades Handbook:"
 - (1) "Brick Masonry," (2) "Chimneys and Fireplaces," (3) "Hollow-Tile Construction."
- (r) See the nine publications of the Building Brick Association of America listed under 3C8.
- (rr) See "Hollow Tile Construction," N. F. P. A. Quarterly (3A4h), Vol. 7, No. 1; and "Terra-cotta or Tile Blocks," Vol. 4, No. 4.
- (s) Read "Standardizing Face Brick," F. W. Donahoe, "Brick and Clay Record," October 3, 1916.
- (ss) "The Development of the Ceramic Industries in the U. S." A "communication" by A. V. Bleininger, presented before the Franklin Institute, Philadelphia, Nov. 2, 1916.
 - (1) See "Brick Houses and How to Build Them," Radford.
 - (2) See "Practical Brick and Tile Book," Dobson-Hammond.
 - (3) See "Clays, Their Occurrence, Properties and Uses," H. Ries.
 - (w) Catalogue, Architectural Exhibition, 1913, St. Louis Architectural Club contains an excellent treatise on brickwork, detailed and illustrated, with an introduction by Wm. B. Ittner.
 - (x) See "Brickwork and Masonry," Mitchell; "Bricks and Tiles," Dobson; "Clay-workers' Handbook," Searles; "Details of Building Construction," Radford.
 - (y) "The Brick Church and Parish House," published 1915 by Hydraulic Press Brick Co., containing Notes on Church Architecture in America and plates and illustrations of the "Brick-builders' Competition."
See also references under Buildings and Structures in General 4B.
See also Other References in February Journal under Stone Masonry 2C4 and under Stone in General, 2J5.
See, also, "Atlantic Terra-Cotta" printed monthly for architects and distributed by that Company.
- (z) For illustrations and other information pertaining to Terra Cotta see pages as follows, in the Industrial Section:
 1. Atlantic Terra Cotta Co., p. 207.
 2. Federal Terra Cotta Co., p. 206.
 3. O. W. Ketcham, p. 208.
With respect to Brick, see:
 4. Hydraulic Press Brick Co., p. 226.
 5. O. W. Ketcham, p. 208.
With respect to Roofing Tile, also Hollow Tile Fireproofing, see:
 6. O. W. Ketcham, p. 208.

3D2 Practice Recommended and Suggested

By N.F.P.A.

- (a) "Chimneys, Flues and Fireplaces, To Provide for the Safe Construction of" (3A3ct).
- (b) Field Practice (3A3d1): Chapter II, "Furnace Stacks, Chimneys and Flues;" Chapter VII, "Chimneys and Flues, Their Common Dangers, Means of Safe Construction, Repairing and Maintenance."
- (c) "Chimneys, Flues and Fireplaces" (3A3e3).

By National Board of Fire Underwriters:

- (d) Building Code (3A4d1): Part VI, "Walls," pp. 34-50.
- (e) "Dwelling Houses" (3A4d3): Part III, "Walls," pp. 21-31. See, also, 3A4d2 and d4.

By National Terra Cotta Society:

- (f) See 3C4b, c, and d. The School, The Theatre and Store-fronts. See, also, Standards (3C4a), the same, though showing carefully prepared detailed drawings for construction, does not include any basic recommendations or specification data for setting.

By National Fireproofing Co.:

- (g) For suggested details of wall construction with hollow-tile building-blocks and for "Manufacturers' Standard Specifications" prepared by that Company in collaboration with the editor of the Structural Service Department while acting as Consulting Architect to Sweets Catalogue Service, see pp. 304, 305, "Sweets Architectural Catalogue, 1916."

3D3 Standards Adopted

(Independent of existing municipal and state building codes which obtain in respective localities.)

By the N.F.P.A.:

- (a) "Specifications for Construction of a Standard Building" (3A3d31)

By the National Terra Cotta Society:

- (b) "Architectural Terra Cotta, Standard Construction (3C4a).

By the National Brick Manufacturers' Association (3C6b.):

- (c) The following are the sizes officially adopted as Standard: Common brick, $8\frac{1}{4} \times 4 \times 2\frac{1}{4}$ inches; paving brick, $8\frac{1}{2} \times 4 \times 2\frac{1}{2}$ inches; pressed brick, $8\frac{3}{8} \times 4 \times 2\frac{3}{8}$ inches; Roman brick, $12 \times 4 \times 1\frac{1}{2}$ inches; Norman brick, $12 \times 4 \times 2\frac{3}{8}$ inches.
It is to be noted that, due to the different kinds of clay used and varying degrees of heat by reason of location of bricks in the kiln, these sizes will naturally vary slightly, though presumably not enough to affect any layout which allows for ample jointing.

By the A.S.T.M. (1A4c):

- (d) "Standard Specifications for Paving Brick," Serial Designation C7-15.

By Navy Department, U. S. A. (3A1a2):

- (e) "Brick and Cement, Fire," Navy Dept. Specification, 50B6, May 1, 1916.
(f) "Bricks and Cements, Converter and Open Hearth," Ditto, 50B5, May 1, 1916.

By the National Paving Brick Manufacturers' Association:

- (g) "Specifications for the Construction of Vitrified Brick Street Pavements and Country Roads" (3C9b).

By the Refractories Manufacturers' Association:

- (h) "Standard 9 inch and 9 inch Series Brick Shapes" (3C3a).
(j) Tables showing the number of bricks required to turn various circles (3C3b).

3D4 Progress and Current Activities

(a) *Strength of Brick Piers.* The investigation of the strength of large brick piers, which has been conducted during the previous two years, has been confined to brick selected from the important geographical districts east of the Mississippi. The bricks have been classified individually according to the tentative standards recommended by the American Society for Testing Materials. The experimental work of this investigation has been completed for piers constructed from the product of the Chicago and Pittsburgh districts. The work will be continued for the remaining districts during the coming year. This research is being carried on in coöperation with the National Brick Manufacturers' Association.—From Report Bureau of Standards, 1916, 1A2a.

(b) *Strength of Hollow Building Tile.* During previous years, numerous tests of building tiles from different geographical districts have been made, and the data is being studied and coördinated for publication. In addition, a number of tile walls have been tested under compression and transverse forces to determine the physical laws and most efficient types of construction, appropriate mortars, best type of bond, and the relation of strength to hardness of burn. This investigation will be continued during the coming year. It is hoped to furnish adequate data for outlining standard methods of testing tile and preparing consistent specifications for the use of manufacturers and engineers.—From Report Bureau of Standards, 1916, 1A2a.

(c) *Effect of Pressure upon Fire-Bricks at Furnace Temperatures.* In coöperation with the American Gas Institute and the American Refractories Manufacturers' Association, tests have been carried on for the purpose of correlating the effect of varying pressures upon clay fire-bricks at the temperatures 1,300 degrees and 1,350 degrees C. The results obtained have been made the basis of tentative specifications to be adopted by the Gas Institute.—From Report Bureau of Standards, 1916, 1A2a.

3D5 Metal Lath, Gypsum, Asbestos and Wired Glass.

Further reference to these will be made under later serial numbers.

- (a) See "Mineral Resources of the U. S.," Part Non-Metals (2A1, 2), chapters on Gypsum and on Asbestos.
(b) The U. S. Bureau of Mines (2A3) expects to issue within the next few months a report on the manufacture of gypsum.
(c) For references to metal lath in this section see 3C11 and 3E3g. Also under Fire Tests (3E2) and under Lathing and Plastering (11D6). For further information and detailed drawings see Industrial Section, pp. 162-167, Associated Metal Lath Manufacturers.
(d) The application of wired glass will be referred to under "Vertical Structural Features" in April, Serial No. 4, and is included in many of the Reports under 3E1. It is also referred to especially under "Wire Glass, Roof openings and vault Lights" (12F2).
(e) Gypsum for floors and partitions will be referred to in April, and is also referred to under 4K3, 11C1, 11D3, and elsewhere as listed in the General Index.
(f) For Asbestos roofing, see 4D1p, 4D3e and 11D2.

3E1 Reports on Buildings Under Fire, and

3E2 Reports on Fire Tests of Materials

(See, also, Buildings and Structures in General, Serial No. 4.)

- (a) U. S. Geological Survey (2A1g), Bulletin 324, 163 pp. text, 55 plates and two maps. (50 cts.) "The Effects of the San Francisco Earthquake and Fire on Various Structures and Structural Materials," 1907, Richard L. Humphrey. Pp. 14-61. Also contains "The Effects of the San Francisco Earthquake and Fire on Buildings, Engineering Structures and Structural Materials," J. S. Sewell. Pp. 62-130. Also, "The Earthquake and Fire and Their Effects on Structural Steel and Steel-frame Buildings," Frank Soulé. Pp. 131-158.
(b) Same Bulletin gives over forty references for other articles particularly with respect to the earthquake and effects.
(c) Survey, Bulletin 370 (2A1g), 99 pp., illustrated. (30 cts.) "The Fire Resistive Properties of Various Building Materials," Richard L. Humphrey. Contains results of tests of thirty panels of various building materials made by the U. S. Geological Survey with a furnace in the Underwriters' Laboratories, Chicago.
(d) See the twelve "Special Fire Reports" listed under publications available in the files of the National Fire Protection Association 3A3f, 1-12.
(e) See "Index" to all publications of the N. F. P. A. (3A3h) including *The Quarterly* which contains in each issue matter of interest to architects and other constructionists. Seventeen references to Conflagration alone. Fifteen references to Records of Fires in Fire-resistive Buildings.
(f) "Concrete Storehouse of Naumkeag Steam Cotton Company Which Successfully withstood the Salem Conflagration," Inspection Dept. Associated Factory Mutual Fire Insurance Companies 3A7a4o.
(g) See "Burning of the Edison Phonograph Works," and other publications of the Inspection Department, Associated Factory Mutual Fire Insurance Companies, 3A7a and b.
(h) "Report of the Committee on Edison Fire." Cass Gilbert, Chairman. Published by American Concrete Institute (1E4s), 1915.
(j) "Report on a Fire in Reinforced Concrete Warehouse at Far Rockaway, N. Y., November 10, 1916," Committee on Construction of Buildings, National Board of Fire Underwriters (3A4). Upon application to Ira H. Woolson, Consulting Engineer to the Committee.
(k) See "Fire-Prevention and Fire-Protection," Joseph Kendall Freitag.
(1) "Experimental Testing Stations," Chapter V.
(2) "Fires in Fire-resisting Buildings, and Conflagrations," Chapter VI.
(l) See "The Fireproofing of Steel Buildings," Joseph Kendall Freitag.
(1) "Fires in Fireproof Buildings," Chapter III.
(2) "Tests of Fireproof Floors," Chapter IV.
(m) See "Fire Tests of Floors in the United States" (under "Horizontal and Sloping Features," Serial No. 4D).
(n) See "Tests of Fire-resistive Construction," Proceedings N. F. P. A. (3A4h), Vol. 18, p. 217.
(o) For reports of tests on metal-lath construction made at Cleveland, and at New York, see "Metal Lath Hand Book" 3C11a, and Industrial Section, p. 164.
(p) See 3E3g for progress report on fire tests.
(q) See Report of Committee of American Society of Civil Engineers on San Francisco Fire (to which reference is made in Industrial Section on p. 165).

3E3 *The U. S. Bureau of Standards and Fire Tests*

(a) With an annual life and property loss conservatively estimated as some thousands of lives and exceeding \$300,000,000, a per capita loss nearly ten times as great as that found in the leading European countries, and this in spite of the most expensive and efficient fire-fighting equipment in the world, it would be a neglect of duty not to direct attention to the pressing needs for greater activities on the part of the National Government in the nationwide movements to diminish this unpardonable waste of our national resources. The National Fire Protection Association, through its 125 or more allied engineering, industrial, commercial, municipal, and state associations, has done, and is now doing, splendid and unselfish work in this great public movement. It is the moral duty of the National Government to lend its fullest coöperation and assistance to this great work.

The field of activity in which the Bureau can be of the greatest service to the many organizations now enlisted in the fight against our enormous fire-waste is in the determination of fundamental engineering data to serve as a basis for the revision and reconstruction of state and municipal building codes. The important investigations now under way that are expected to yield data of direct practical application are the fire-tests of structural steel building columns, fireproofed in different ways, and of reinforced concrete columns of different aggregates and types of construction.

It is imperative that tests of floors, roofs, fire-resisting doors, shutters, and windows, must be included in this program, and must be carried along with the column and partition tests, if we are to be in a position at the end of a few years to lay before American engineers a comprehensive set of data to enable them to redraft our present unsatisfactory codes in the light of the best modern engineering experience.—From 1916 Report of Director Stratton to the Secretary of Commerce.

Fire-Tests of Building Columns

(b) Many millions of dollars are annually spent on the construction of buildings the integrity of which, in the event of fire, is dependent on the behavior of the steel columns supporting the structures. Very little engineering data are available which would permit of any certain conclusions as to the thickness and kind of fireproof covering required to render these columns safe under various conditions of fire-hazard. The requirements of city building codes on these questions are so different that it is evident that some codes are either requiring an unnecessarily thick fireproof covering, with undue increase in construction costs, or else other codes are requiring too thin coverings, with undue increase in danger to the stability of the structure under the existing fire-hazards.

The fire-tests on building columns are being carried out jointly by the Underwriters' Laboratories of Chicago, the Mutual Laboratories of Boston, and the Bureau of Standards. The first series of tests was originally planned to include about seventy structural steel columns and about six reinforced concrete columns. During the past year, while the steel columns were being fabricated and assembled and the various aggregates and covering materials were being brought together from different parts of the country, a detailed syllabus of the proposed tests was prepared and sent to several hundred engineers and architects interested in fireproof building construction as well as to various technical societies with a request for criticisms and suggested modifications of the proposed program of tests.

At a conference of the several laboratories jointly conducting these tests, held at Pittsburgh in March, 1916, the many valuable suggestions and criticisms called forth by the publication of the syllabus were carefully considered, and the program of tests was finally revised. While the original program was modified in many minor but important details in accordance with the suggestions that had been received, the most important modification consisted in the addition of about twenty fireproofed structural steel columns which will be subjected to the combined action of fire and water, the water being applied after a one hour's exposure to fire.

The specially designed furnace, which is being erected by the engineers of the Underwriters' Laboratories especially for these tests, together with the 200-ton hydraulic jack for applying loads of fifty tons to the columns while exposed to fire, the trolley cranes for moving the walls of the furnace to permit of the application of water, have been installed, with the exception of the burner for heating the furnace by means of natural gas. The steel columns, representative of the types commonly employed in building construction, are now being covered with concrete, plaster on metal lath, clay tile, and gypsum tile coverings. Thermocouples are being built into the column coverings to enable the temperature changes of the structural steel to be followed throughout the course of the fire-test. Some of the important parts of the specially designed deformeter for measuring the amount of deformation produced in the column during the test have been completed. It is confidently believed that the results of these tests will be a most important contribution to modern structural engineering.—From Report, Bureau of Standards, 1916, 1A2a.

[NOTE.—There has just been received a document issued jointly by the Bureau of Standards, the Associated Factory Mutuals and the National Board of Fire Underwriters with diagrams and descriptive details of the above tests. This is entitled "Prospectus of Fire Tests of Building Columns."]

Thermal Efficiencies of Column Coverings

(c) Tests have been under way during the past two years at the Pittsburgh branch laboratories of the Bureau on the rate of temperature rise within cylindrical specimens of the various materials used for fireproofing building columns. A special gas heating furnace was built for this work, and a large number of cylinders of different materials were tested with thermocouples mounted axially in the cylinder and with their junctions at different distances from the surface. Cylinders similar to the cylinder under test were placed at each end of the latter, in contact with its end faces, to minimize the disturbing effects of heat losses from the ends. This investigation is practically completed with the exception of a few tests to round out the series. It will be prepared for publication as soon as time will permit.

(d) Some tests on the compressive strength of steel at high temperatures, briefly reported in the last annual report, showed that at 600 degrees C. the compressive strength had decreased to 60 per cent, and in the next 50 degrees C. (i. e. at 650 degrees C.) to about 30 per cent of its value when cold. Such data are of fundamental importance in their bearing on the behavior of structural steel when exposed to fire conditions.—From Report, Bureau of Standards, 1916, 1A2a.

Panel-Testing Furnace

(e) The panel-testing equipment was installed during the year. The plant has been operated several times to test its performance and has been found admirably suited to the work for which it has been designed. The equipment that is now available for this work is probably the

most complete that has ever been built, and its efficient utilization should include as a minimum thirty panel tests a year.

Steps have been taken to secure the coöperation of prominent engineers, representatives of engineering and technical societies, and of manufacturing associations, in the formulation of a comprehensive program of tests of the fire-resisting properties of structural materials.—From Report, Bureau of Standards, 1916.

(f) For tests at the Bureau on Fire Brick see 3D4c.

(g) As we go to press there has been received a copy of a new publication of the Bureau of Standards—Technologic Paper No. 70—entitled “Durability of Stucco and Plaster Construction.” (For later reference, see 11D6 c and d.)

This paper presents a report of progress in an investigation of stucco and plaster undertaken by the Bureau of Standards five years ago in coöperation with the Associated Metal Lath Manufacturers. In 1915 a test building,

200 feet long, was erected, having fifty-six panels representing the common types of stucco construction including a variety of mixtures on metal lath, wood lath, hollow tile, brick, concrete, block, plaster board, gypsum block and concrete bases. Examination of the panels six months after completion showed that a number were in poor condition. About forty were rated as satisfactory, the remainder being in various stages of deterioration. It is evident that the smooth type of finish known as the sand-float finish is well adapted to bringing out the small defects, such as cracks, blotches, uneven texture, etc. This paper contains suggestive information, but definite recommendations are deferred until further service-test results are known. Those interested may obtain a copy by addressing a request to the Bureau of Standards.

For the Underwriters' Laboratories and Fire and Other Tests, see Serial No. 4, April, with report of the Institute's Special Committee.

3A3 List of Publications Available in the Files of the National Fire Protection Association

See also, 3A3, on page 32, of which this is a classified extension, correct to March 1, 1917.

Membership in the Association is open to any society, corporation, firm or individual interested in the protection of life or property against loss by fire. Annual dues, individuals, \$6.

All the valuable engineering and popular literature issued by the Association is sent, as issued, to every member.

The Association is always glad to send samples of its publications to prospective members.

Copies of the Standards, model state laws and city ordinances, committee reports, and miscellaneous publications given below, will be mailed on application to

FRANKLIN H. WENTWORTH, *Secretary*,
87 Milk Street, Boston, Mass.

NOTE.—Where no price is quoted the publications are free. Prices given are for single copies. Discounts for publications in quantities can usually be given.

(a) Standard Regulations for Fire-Protection and the Safeguarding of Hazards:

1. Acetylene Gas Machines, Oxy-Acetylene Heating and Welding Apparatus and Storage of Calcium Carbide.
2. Blower Systems for Heating and Ventilating, Stock and Refuse Conveying.
3. Dip Tanks, Construction and Installation.
4. Electric Wiring and Apparatus (National Electrical Code).
5. Electrical Fittings, List of Approved.
6. Fire Brigades, Private.
7. Fire Pumps, Steam.
8. Fire Pumps, Rotary and Centrifugal and Electrical Driving of Fire Pumps.
9. Fuel Oil, Storage and Use, and Construction and Installation of Oil-burning Equipments.
10. Gas Shut-Off Valves.
11. Hazardous Liquids, Containers for Storing and Handling.
12. Hose Couplings and Hydrant Fittings, for Public Fire Service.
13. Hose-Houses for Mill-yards, Construction and Equipment.
14. Internal Combustion Engines (gas, gasoline, kerosene, fuel-oil) and Coal-gas Producers (pressure and suction systems).
15. Lightning, Suggestions for Protection against.
16. Municipal Fire-Alarm Systems.
17. Nitro-Cellulose Motion-Picture Films (storage and handling).
18. Protection of Openings in Walls and Partitions.
19. Signaling Systems Used for the Transmission of Signals Affecting the Fire-hazard.
20. Skylights.
21. Sprinkler Equipments, Automatic and Open Systems.
22. Steam Pump Governors and Auxiliary Pumps.
23. Tanks (gravity and pressure), Concrete Reservoirs and Valve-pits.
24. Vaults.

NOTE.—The above Regulations have also been adopted by and are the official standards of the National Board of Fire Underwriters.

(b) Suggested State Laws for regulating fire-hazards:

1. State Fire Marshal Law (of the Fire Marshals' Association of North America).
2. Explosives, To regulate the manufacture, storage, sale and use of.
3. Explosives, To regulate the transportation and carriage of.
4. Matches, To regulate the manufacture, storage, sale and distribution of.

(c) Suggested Municipal Ordinances for regulating fire-hazards:

1. Chimneys and Flues, To provide for the safe construction of chimneys, flues and fireplaces.
2. Ordinances for Small Municipalities (including Building Code).
3. Fireworks, To prohibit the discharge or firing of fireworks and other pyrotechnic display and to limit their storage.
4. Explosives, To regulate the manufacture, keeping, storage, sale, use and transportation of.
5. Inflammable Liquids and the Products Thereof, To regulate the use, handling, storage and sale of.
6. Inspection of Premises by the Fire Department (with sample of Inspection Blank).
7. Matches, To regulate the manufacture, storage, sale and distribution of.
8. Motion-Picture Machines, To regulate the installation, operation and maintenance of.
9. Theatres, To regulate the construction and equipment of.

NOTE.—The above Model Laws and Ordinances have also been officially adopted by the National Board of Fire Underwriters.

(d) Educational:

1. Field Practice. Inspection Manual designed for the use of property owners, fire departments and inspection offices in safeguarding life and property against fire. This handbook is printed on bond paper and is substantially bound in real leather. The dimensions (4½ x 6½ inches) make it a most convenient size for the coat-pocket. This information represents the latest thought of the leading American fire-prevention engineers, and is not elsewhere accessible. Price, postpaid, single copies, \$1.50.
2. Story of the National Fire Protection Association.
3. Syllabus for Public Instruction in Fire-Prevention.
4. A Campaign to Prevent Fire, address of Franklin H. Wentworth. Published by the Canadian Manufacturers' Association.
5. Fire-Prevention, Its Object and Possible Results, C. Heller.
- 5a. Fire-Prevention Through Adequate Power and Common Sense, Clement J. Driscoll.
- 5b. Topics for Fire-Prevention Meetings.
6. Fire Waste Overtaking Insurance Capital, Committee on Publicity and Education.
7. Fire Losses in U. S. \$30,000 an Hour and What Individuals and Communities Can Do to Reduce Them, Committee on Publicity and Education.
8. Will You be a Fire Warden and Life Saver? (1) In the Home. (2) In the Store and Factory. Committee on Publicity and Education.
- 8a. Safeguarding School Children from Fire. Price, 15 cents.
9. Fire-Prevention Work in Small Cities and Towns, Committee Report.
10. Debarment of City Conflagrations, Albert Blauvelt.

STRUCTURAL SERVICE BOOK

11. Inspection of Buildings and Contents by Uniformed Members of Fire Departments, Fire-Chief H. C. Bunker, Cincinnati, Ohio.
 - 11a. Building Inspection by Firemen: Suggestions for systematic procedure, James Crapo, Battalion Chief, Chicago Fire Department.
 12. Individual Liability Laws for Fires Due to Carelessness or Neglect. Public Fire Departments, George W. Booth. Price, 5 cents.
 - 13a. Volunteer Fire Departments: Organization and Conduct, Harry W. Bringham.
 14. Architects: General Information Regarding Fire Insurance Requirements.
 15. Fire Exits, Outside Stairs for: Recommendations for their Construction and Installation. Price, 5 cents.
 16. Exit Drills for Factories, Schools, Department Stores and Theatres: Suggestions for Their Organization and Execution. Price, 5 cents.
 17. The Wooden Apartment House, the Fight Against it in Brookline, Mass., Gorham Dana.
 - 17a. Dwelling Houses: Suggestions for Their Construction and Protection, National Board of Fire Underwriters. Price, 10 cents.
 - 17b. Shingle Roofs as Conflagration Spreaders, National Board of Fire Underwriters. Price, 5 cents.
 18. Fire Stories for Children, Committee on Publicity and Education.
 19. Fire-Prevention Day Programs for Public Parade, School Exercises, Evening Assembly. Price, 10 cents.
 20. Fire-Hazards Due to Trolley Circuits, Samuel S. Wyer.
 21. Fire-Hazards on the Farm.
 22. Automobile Fire Apparatus, Committee Report, 1913.
 - 22a. Automobile Combination Pumping Engine and Hose-Wagon.
 - 22b. { Gasolene Combination Chemical Engine and Hose-Wagon.
 { Gasolene Combination Service Ladder-Truck.
 23. High-Pressure Systems for Fire Service, Committee Report.
 24. Fire-Service Connections, Protection of, H. O. Lacount.
 25. Fire-Hose: The need for a better quality of Public Department Fire Hose, Committee Report.
 26. Fire-Pumps: Notes and Suggestions on Same, Associated Factory Mutual Fire Insurance Companies. Booklet, 53 pages, illustrated. Price, 15 cents.
 27. National Standard Hose Couplings and Hydrant Fittings for Public Fire Service: Progress in their Adoption by Cities of United States, F. M. Griswold.
 28. Elevated Tanks: Their Improved Design and Construction, W. O. Teague. 23 pages. Price, 5 cents.
 29. Water Barrels and Pails for Fire Protection, W. R. Ruegnitz. Price, 5 cents.
 30. Freezing Preventives for Water Pails and Chemical Extinguishers, J. Albert Robinson. Price, 5 cents.
 31. Fire-resistive Construction, Specifications for, Committee Report.
 - 31a. Office Building, Grade A, Specifications for Construction of.
 32. Factories and Their Fire Protection, Franklin H. Wentworth. Price, 5 cents.
 - 32a. Mill Construction Buildings, C. E. Paul. Price, 5 cents.
 - 32b. Structural Defects, Suggestions for Their Elimination and Protection. Price, 5 cents.
 33. The Automatic Control of Fire, Fitzhugh Taylor. Price, 5 cents.
 34. Explosions, Dust and Smoke, P. D. C. Stewart.
 35. Smoke and Water Damage, F. E. Roberts.
 - 35a. Sprinkler Leakage, Albert Blauvelt. Price, 5 cents.
 36. Uses of Wood in Building Construction, Committee Report. Data of tests on inflammability of untreated wood and of wood treated with fire-retarding compounds. 55 pages, illustrated. Price, 25 cents.
 37. The Permanent Fireproofing of Cotton Goods, William Henry Perkins. Price, 5 cents.
 38. Cordage Fibers: Their Physical Properties, Hazards and Characteristics, T. E. Sears. Price, 5 cents.
 39. Color, Paint and Varnish Factories: Processes and Hazards, F. E. Roberts. 31 pages. Price, 5 cents.
 40. Lumber and Lumber Drying, with Notes on Steam Jets, Committee Report. Price, 5 cents.
 41. Tanneries: Suggestions for Their Improvement as Fire-Risks, Committee Report. Price, 5 cents.
 42. Shoe Factories: Suggestions for Their Improvement as Fire-Risks, Committee Report. Price, 5 cents.
 43. The Cooperage Industry, J. Albert Robinson.
 44. Cold-Storage Warehouses: Suggestions for Their Improvement as Fire-Risks, Committee Report. Price, 5 cents.
 - 44a. Refrigerating Machinery Explosions and Fires. Price, 5 cents.
 45. Inspected Mechanical Appliances. Published by Underwriters' Laboratories, Inc. List includes inspected devices and materials, fire appliances, gas, oil, mechanical and chemical appliances. (Revised semi-annually—January and July.)
- (e) *Special Bulletins:*
1. Dwelling-House Hazards: How to Prevent Fires in the Home. 4 pages, illustrated. Price, \$1 per 100, \$7.50 per 1,000.
 2. The Evil Wooden Shingle. 4 pages, illustrated. Prices, \$1 per 100, \$7.50 per 1,000.
 3. Chimneys, Flues and Fireplaces: How to Build Them. 4 pages, illustrated. Price, \$1 per 100, \$7.50 per 1,000.
 4. School-Houses, Fire Protection of. 16 pages, illustrated. Price, 10 cents per copy. Special discount for quantities.
 5. Holiday Bulletins. Illustrated four-page bulletins are prepared for circulation preceding Independence Day and Christmas Day, warning against the hazards of fireworks and inflammable decorations, temporary electric wiring, etc. Price, \$1 per 100, \$7.50 per 1,000.
 6. Frozen Water-Pipes: A Winter Fire-Hazard. Price, 60 cents per 100, \$5 per 1,000.
 7. Electric Pressing-Iron Fire-Hazard. Price, \$1 per 100, \$7.50 per 1,000.
 8. Storage of Bituminous or Soft Coal. Price, 60 cents per 100, \$5 per 1,000.
- (f) *Special Fire Reports:*
1. The Baltimore Conflagration, February 7, 8, 1904. 130 pages, illustrated. Committee Report. Price, 25 cents.
 2. Parker Building Fire, July 10, 1908. 56 pages, illustrated. Report by New York Board of Fire Underwriters. Price, 15 cents.
 3. The Equitable Building Fire, January 9, 1912. 50 pages, illustrated. Report by New York Board of Fire Underwriters. Price, 15 cents.
 4. Binghamton Clothing Company Fire, July 22, 1913. 12 pages, illustrated. Committee Report. Price, 10 cents.
 5. Melvin Apartment House Fire, Boston, April 14, 1914. 4 pages, illustrated. Price, 1 cent.
 6. Cleveland Lumber and Public Property Fire, May 25, 1914. 8 pages, illustrated. Report by Cleveland Inspection Bureau. Price, 5 cents.
 7. *Salem, Mass., Conflagration, June 25, 26, 1914. 16 pages, illustrated, maps. Price, 10 cents.
 8. Edison Phonograph Works, West Orange, N. J., December 9, 1914. 60 pages, illustrated. Price, 25 cents.
 9. Diamond Candy Company Factory Fire Holocaust, Brooklyn, N. Y., November 6, 1915. 16 pages, illustrated. Price, 5 cents.
 10. Paris, Texas, Conflagration, March 21, 1916. 8 pages, illustrated, map. Price, 5 cents.
 11. Nashville, Tennessee, Conflagration, March 22, 1916. 8 pages, illustrated, map. Price, 10 cents.
 12. Augusta, Georgia, Conflagration, March 22, 1916. 16 pages, illustrated, map. Price, 10 cents.
- *Out of print.
- (g) *No Smoking:*
- Signs, black ink on red card. Price, 5 cents. Discount for quantities.
- (h) *Publications for Members Only:*
- News Letter. A monthly bulletin of special information on current items of interest to those charged with the responsibility of safeguarding life and property from fire.
- Proceedings of Annual Meeting. Containing stenographic report of transactions of the Association and the discussions incident to the adoption of its standards. Extra copies, \$1.
- Quarterly Magazine of the Association. A chronicle of the Association's activities, with valuable contributions of articles on fire-prevention and -protection, and special hazards, and compilations of fire statistics on various classes of property. Extra copies, 50 cents.
- Year-book and directory. Complete list of members with addresses. Index to all subjects covered in the printed records. (Proceedings, Quarterly, etc.)
- Special reports, bulletins, etc., issued during the year.
- [NOTE.—Each member receives one copy of all the Association's publications current during the year of his membership. Membership year begins with date of election.]

3A4 List of Publications Available in the Files of the National Board of Fire Underwriters

(See, also, 3A4 on page 33, of which this is a classified extension, correct to March 1, 1917.)

Copies may be obtained, without charge (except *d3*, upon which a charge of 10 cents is made to cover postage), by qualified inquirers, by addressing The National

Serial No. 3

Board of Fire Underwriters, 76 William St., New York City.

(a) Suggested Regulations of the National Board of Fire Underwriters for the installation of devices. Recommended by the National Fire Protection Association.

The list embracing these is the same as the (a) list of the N. F. P. A. on page 43, with the addition of the following:

25. Gasoline Vapor Gas Lighting Machines.
26. Railway Car Storage.
27. Electrical Appliances, List of Approved.
28. Underwriters' Laboratories.

The latter two are the same publications as mentioned by the Underwriters' Laboratories.

- (b) Suggested State Laws issued by the N. B. F. U. For use by State Officials in framing regulations on matters pertaining to Fire Prevention and Building Construction.

These are the same as the four mentioned in the (b) list of the N. F. P. A.

- (c) Suggested Separate City Ordinances issued by the N. B. F. U. for use by City Officials in framing regulations on matters pertaining to Fire Prevention and Building Construction.

- *1. To Regulate the Installation, Operation and Maintenance of Motion Picture Machines, and the Construction and Arrangement of Picture Booths and Audience-Rooms.
- *2. To Regulate the Manufacture, Storage, Sale and Distribution of Matches.
- *3. To Regulate the Manufacture, Keeping, Storage, Sale, Use and Transportation of Explosives, in Cities Whose Population Exceeds 100,000 Inhabitants.
4. To Regulate the Manufacture, Keeping, Storage, Sale, Use and Transportation of Explosives, in Villages or in Cities Whose Population Does Not Exceed 100,000 Inhabitants.
5. To Govern the Construction and Operation of Laundries.
- *6. To Regulate the Construction and Equipment of Theatres.
- *7. To Regulate the Use, Handling, Storage and Sale of Inflammable Liquids and the Products Thereof.

8. Shingle Roofs as Conflagration Spreaders: An appeal to the Civil Authorities and Civic and Commercial Bodies. Contains an Ordinance for Fire-resistive Roof Coverings.

*These are evidently the same as 4, 5, 7, 8 and 9 in the (c) list of the N. F. P. A. 8 is listed D17b in N. F. P. A.

- (d) Suggested Codes issued by the N. B. F. U. For use by State and City Officials in framing regulations on matters pertaining to Fire Prevention and Building Construction.

1. A Recommended Building Code, suitable for a city of any size and providing for fire limits, and regulations governing the construction, alteration, equipment, repair or removal of buildings or structures.
2. A Suggested Building Ordinance for Small Towns and Villages: Providing for fire limits and the construction and equipment of ordinary non-fireproof buildings.
3. Dwelling Houses: A Code of Suggestions for the Construction and Fire-Protection. Intended especially as an aid in construction of isolated homes outside the control of building ordinances, and is addressed directly to the owners of dwellings, and to carpenters and builders who erect them.
4. A Code of abbreviated Ordinances for Small Municipalities, and containing ordinances providing for Fire Limits and the Construction and Equipment of Buildings; the regulation of Garages; the regulation of Motion Picture Machines and Premises where operated; the Inspection of Premises by the Fire Department; also a blank form for use by the inspector; the Cleanliness of Streets, Alleys and Premises; the Burning of Refuse; the Storage of Explosives; Fire Escapes, and prohibiting the Discharge of Fireworks.

No. 3. will be found under D17a N. F. P. A. list.

3A7 List of Publications Available in the Files of the Inspection Department, Associated Factory Mutual Fire Insurance Companies

(See also 3A7 on page 35, of which this is a classified extension, correct to March 1, 1917.)

Single copies of these publications may be obtained on request without charge, except Nos. 9 and 45, and (c), which will be furnished at a price of 25 cents per copy. Where additional copies of any of the pamphlets are desired, a charge sufficient to cover the cost of printing will be made.

(a) Pamphlets:

1. "Anchorage of Roofs."
2. "Approved Electrical Fittings."
3. "Approved Fire Protection Appliances."
4. "Beltway Fires."
5. "Carbon Tetrachloride as a Cleaning and Solvent Agent."
6. "Centrifugal Fire Pumps—Specifications, and Rules for Electrical Driving." (Included in No. 20.)
7. "Cotton Conveying Systems from Bale to Opener Room."
8. "Dry-Pipe Systems of Automatic Sprinklers—Rules."
9. "Electric Light and Power Equipment—Rules."
10. "Fire Hose, Play Pipes and Hose Houses—Rules."
11. "Fire Pump Protection for City Risks (Paterson Fire)."
12. "Fires in Cotton Mills."
13. "Fuel Oil Installations for Furnaces and Engines."
14. "Gravity Tanks and Towers—Specifications."
15. "Installations for Handling Gasoline and Similar Oils."
16. "Installing Sprinkler Equipments—Rules."
17. "Laying Cast Iron Water Pipes in Factory Yards—Rules."
18. "Notes and Suggestions on Fire Pumps."
19. "Prevention of Large Loss in a Mutual Mill."
20. "Rotary and Centrifugal Fire Pumps—Specifications and Rules for Electrical Driving."
21. "Sawdust as an Extinguisher of Fires in Moderate Sized Tanks of Lacquer, Paint, etc."
22. "Sprinkler Protection in Picker Trunks, Dryers, etc."

The Fire-Prevention and -Protection issue will be concluded in the April number, Serial No. 4, with the Section on General Building Construction.

23. "Steam Pump Governors and Auxiliary Pumps—Specifications."
24. "Underwriter Steam Fire Pumps—Specifications."
25. "Valves, Indicator Posts and Hydrants—Specifications."
26. "Water-tight Floors of Mill Construction."
40. "Concrete Storehouse."
41. "Fire Doors."
42. "Humidity for Preventing Fires in Rubber Factories."
43. "Mill Watchman."
44. "Edison Phonograph Works, Burning of."
45. "Dry Rot in Factory Timbers."
46. "Salem Conflagration."
47. "Fire Hazards in Charcoal."
48. "Mill Fire Brigades."
49. "Fire Protection of Pyroxylin Plastics (Celluloid)."

(b) Leaflets:

27. "Directions for Use of Red Tags on Closed Valves."
28. "Fire Brigades Inside Mill."
29. "Mill Fire Brigade Data and Sheets."
30. "Rotary Fire Pumps—Directions for Starting."
31. "Steam Fire Pumps—Directions for Starting."
32. "Weekly Inspection of Fire Protective Apparatus. A Suggestive Form of Blank."
33. "When Putting in Fire Protection—Things to be Considered."
34. "Failure of Public Water Supplies."
35. "Gage Connection for Use in Testing Main Controlling Valves."
36. "Longleaf Pine Factory Timber."

(c) Report No. 5— Mill Construction:

The work of the Insurance Engineering Experiment Station under direction of Boston Manufacturers Mutual Fire Insurance Company was taken over by The Associated Factory Mutual Fire Insurance Companies several years ago; notable among their publications was Report No. 5 on Slow Burning, or Mill Construction, which will be furnished at 25 cents a copy.

Current Comments

Refer to 1E4:

We have recently received Bulletin No. 25, "Public Works of the Navy," under the cognizance of the Bureau of Yards and Docks and the Corps of Civil Engineers, U. S. Navy, for January, 1917; included in which is eleven pages giving bibliographies and abstracts of published articles on the "Durability of Concrete in Sea Water."

Refer to 1E7b:

We are in receipt of a letter from Ernest McCullough, Chief Engineer Fireproof Construction Bureau of the Portland Cement Association, accompanying a copy of the "Final Report of the Joint Committee on Concrete and Reinforced Concrete." He states that the Portland Cement Association purchased a few copies for distribution and as long as these copies are available they will be sent free upon request to architects, engineers and contractors.

Serial No. 4

FIRE-PREVENTION AND -PROTECTION ISSUE

Section 2. General Building Construction

CONTENTS

Attention is directed also to Terra Cotta, Hollow Tile and Brick (3D), to Metal Lath, Gypsum, Asbestos and Wired Glass (3D5), and also to Cement and Concrete (1E) and Structural Steel (1F), which should be considered in connection with fire-prevention and -protection in general building construction, quite independent, of course, of all municipal ordinances and state building codes which obtain in the various parts of the country.

For information and statistics on fire-losses, hazards in

general, theory and practice and other items not specifically referred to herein in connection with structural matters, the reader is referred to the *Quarterly* and other publications of the N.F.P.A. (to find which by items the N.F.P.A. "Index," mentioned under 3A3h, will prove invaluable), and to the publications referred to by titles under Information Obtainable (4B1), also to a pamphlet (180 pages) entitled "A Five Years' Fight against Fire Waste," by Powell Evans, copyright 1912.

APRIL, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

- 4A1** Report Relating to the Work of the Underwriters' Laboratories by the Committee of the American Institute of Architects.
- 4A2** The Committee on Fire-Protection in the American Society of Mechanical Engineers.
- 4A3** National Automatic Sprinkler Association.
- 4B** Buildings and Structures in General, New Construction Work and Safeguarding Old.
- 4C** Walls, Chimneys and Flues; Columns, Partitions and Enclosures; Doors, Windows and Shutters; Wired Glass and other Retardents.
- 4C4** Scuppers, Inserts and Devices.
- 4D** Beams, Girders and Floors; Ceilings and Roof Construction; Roofs and Roof Coverings.
- 4D4** Floor Hangers, Roof Connections and Devices.
- 4D5** Tanks and Reservoirs.
- 4E** Exits—Stairways and Fire-Escapes; Safety to Life; Slipping Hazards.
- 4F** Fittings, Contents and Protection Equipment.
- 4G** Lightning Protection.
- 4H** Fire Insurance.
- 4J** Progress and Current Activities.
- 4K** Structural Matters in General.

4A1 Report Relating to the Work of the Underwriters' Laboratories by the Committee of the American Institute of Architects

Chicago, Ill., March 7, 1917.

To the Members of the American Institute of Architects:

It has long been recognized that there is no feature in the designing and planning of any building that is more vital or important than provision against fire and for the prevention of accidents and loss of life, yet comparatively few people realize that the percentage of loss of buildings by fire in this country, in spite of our organized fire departments and our fire-prevention apparatus, is about as great as any in the world.

In 333 cities in this country, the total annual loss for 1915 is \$68,200,000, or \$1.94 for every individual in those cities. All that fire departments or fire-fighting apparatus can do in a fire is to try to put it out after it has started. The possibility of reducing this great loss does not depend so much on the fire departments or apparatus as it does upon the architects who plan and design the buildings. Whether the blaze once started shall spread to be uncontrollable, or whether the occupants shall have safe exit, or whether they shall be reasonably safeguarded against accidents, depends largely upon the architect.

The insurance companies can only penalize the owners for bad fire- or accident-risks by imposing high insurance rates, and city authorities can do considerable by building ordinances toward making buildings reasonably safe and proof against fire; but architects are in a position to do most when they design and create these buildings by raising the standard of their fire-resisting qualities and their safety. For the purpose, therefore, of determining and accumulating the facts about all those materials and agencies which serve to reduce fire-losses and to prevent accidents to persons, the Underwriters' Laboratories were established in 1901. They are undoubtedly today the greatest and the most scientific source we have for securing such information. They are entirely independent of any corporation, and although self-supporting, they are run without any profit, and their assistance and information can be had by architects for the asking.

Realizing, therefore, this great opportunity and the value of such information to the architectural profession, the American Institute of Architects has appointed the Committee which is the author of this communication to investigate and study the Laboratories and to bring

the architects into closer touch with their work by arranging to have such information and data of the Laboratories as would be most useful brought directly to the attention of the architects. The January issue of the Journal of the American Institute of Architects, in the new Structural Service Department, presents a brief general description of the Laboratories, the scope of their work, and some of the publications to be had, and also a reference to the future publication of information and data of the Laboratories under different headings of the Department.

The Committee on Fire-Prevention of the Institute has also been doing valuable service for years in coöperation with other organizations and in helping to promote the cause of fire-prevention. The American Institute of Architects, however, has felt that there was still a field of work led by the Underwriters' Laboratories of such vital interest to architects that a committee on that subject could find abundant opportunity for usefulness without in any way conflicting with the work of other committees or with the Structural Service Department of the Journal.

The Committee on the Laboratories has therefore undertaken to carry out a plan of witnessing those tests by the Laboratories of building materials and methods of construction most useful to architects, of selecting such information and data as is most suitable for the purpose and causing this to be sent directly to the architects, after first publishing such notices and accounts of tests, etc., in the Journal. In this way the Committee hopes to arouse a new interest among architects on the subject and a better appreciation by them of the great need in this country of better construction in buildings and, particularly, a more effective provision for fire-prevention and avoidance of human accidents.

As an illustration of part of the program adopted by the Committee, the following account is given:

The publication entitled "The Organization, Purpose and Methods of the Underwriters' Laboratories," of 1916, will first be mailed to every architect. This will give a clear understanding of the Laboratories and their work and an illustration in color of the labels used by the Laboratories. Among other uses the book will be a useful reference in recognizing labels as official on fire-doors, wire-glass windows, electrical appliances, and all of those things frequently specified to be labeled. At various

times during the year it is the intention to send out several bulletins containing the results of important investigations and tests by the Laboratories. Among the important tests being made now is that of the modern steel-sash window in its various forms. Particular interest is being taken in the investigation of those windows in large units where the opening is divided by one or more mullions. Such windows in courts, alleys, etc., have been approved heretofore only when the mullions between were fire-proofed in a clumsy way, taking up 6 to 8 inches of space. The new windows going through the test have mullions only 1½ to 2 inches in width. If these windows endure the test successfully—and some of them have already done so—then the insurance authorities will permit them in buildings without adding penalties on the insurance rates, and undoubtedly city building departments will permit them in buildings where now the large mullions are required which shut off so much light.

A test of building columns is shortly to be made which is quite remarkable. Elaborate preparations lasting some months have been made whereby large columns, some 14 feet high, one of cast iron fireproofed, one of steel fireproofed, and one of reinforced concrete, each carrying a load of 250 tons is to be subjected to severe heat, such as would occur in a great fire, and then subjected to a large stream of cold water under high pressure. This will undoubtedly produce some very interesting evidence bearing on the subject so frequently and earnestly debated after the Baltimore and San Francisco fires as to the relative merits of these columns. Information such as this and of other important investigations will be collected and supplied to the architects.

It is the sincere hope of the Committee that the information to be furnished will be of practical use to each architect, that he will feel at perfect liberty to make use of the Laboratories, who earnestly invite coöperation with the architects, and that there will be an improvement in the fire-resisting qualities of new buildings and also greater safeguards against accidents and injuries to persons.

Very respectfully submitted,

*The Committee of the American Institute of Architects
Relating to the Work of the Underwriters' Laboratories.*

ELMER C. JENSEN,
H. WEBSTER TOMLINSON,
GEORGE C. NIMMONS, *Chairman.*

4A2 The Committee on Fire-Protection in the American Society of Mechanical Engineers

(Description of the Society's publications and activities will appear under later serial number.)

This Committee is composed of members who have had experience in the subject and are particularly interested in it. Its Chairman, Mr. John R. Freeman, President of the Manufacturers' Mutual Fire Insurance Company, is a recognized authority upon matters pertaining to fire-protection.

The Committee has not been especially active for the past two years, awaiting results from the investigation of column-protective coverings in progress at the Underwriters' Laboratories in Chicago, but several papers by its members have been presented and published in form for distribution. Among these are the following:

- (a) Safeguarding Life in Theatres, John R. Freeman. This is an exhaustive study of the hazards of theater construction and suggestions for remedying them.
- (b) Allowable Heights and Areas for Factory Buildings, Ira H. Woolson. A compilation and discussion of the opinions of 117 fire chiefs in the principal cities of the United States which were given in reply to a questionnaire upon the subject.

- (c) Department of City Conflagrations, Albert Blauvelt. This deals with the broad problem of methods to prevent conflagration and is published by the N.F.P.A. (3A3d10).
- (d) Life Hazards in Crowded Buildings Due to Inadequate Exits, H. F. J. Porter. Is a plea for the use of the horizontal fire-escape exit by one who has specialized and written frequently on this and other features of building construction with respect to safety to life.
- (e) National Standard Hose Couplings and Hydrant Fittings for Public Fire Service, F. M. Griswold. It describes the necessity for such standardization and the great benefits to be secured by same. (See 3A3d27.)

Membership of the Committee on Fire-Protection, A.S.M.E.:

JOHN R. FREEMAN, *Chairman*
EDWARD V. FRENCH
ALBERT BLAUVELT
F. M. GRISWOLD
H. F. J. PORTER
T. W. RANSOM
IRA H. WOOLSON

4A3 National Automatic Sprinkler Association

Secretary-Treasurer: Ira G. Hoagland, 80 Maiden Lane, New York, N. Y.

Publications:

- (a) "Safety From Fire: The Automatic Sprinkler." December, 1914. A brochure (32 pp.) describing application of automatic sprinkler systems for protection against fire to factories, stores and offices, hotels, schools and colleges, institutions, dwellings and clubs, piers and wharves, and ships and boats.
- (b) Reprints of matter and comments concerning automatic sprinkler protection and related subjects.
- (c) "Automatic Sprinkler Diffuser." Published periodically for the advancement of the automatic sprinkler art as applied to the conservation of life and property from fire.

Purposes:

Advancement of the art of automatic sprinkler protection and promotion of the idea of the protection. Education of the public and its constituted authorities. Dissemination of information; a central source from which architects, engineers and contractors may obtain reliable information concerning the application of automatic sprinkler systems to the protection of property from fire.

Development of opportunities for increased application of sprinkler protection. Elevation of trade and technical practices and solution of economic problems in the automatic sprinkler industry. Opposition of conditions restricting development of the art of automatic sprinkler protection.

Buildings and Structures in General

4B New Construction Work and Safeguarding Old

(See all subdivisions for separate features of construction and for devices.)

(See also "Reports on Buildings under Fire," 3E1, "Cement and Concrete," 1E6, and "Terra-Cotta, Hollow Tile and Brick," 3D.)

4B1 Information Obtainable

- (a) The Bureau of Standards has issued, Jan. 31, 1917: Technologic Paper No. 70. "Durability of Stucco and Plaster Construction" (see 3E3g), being progress report containing results of investigations up to April, 1916.
- (b) See among others the following publications of the N.F.P.A. listed under 3A3a to h. For additional information it is recommended that the "Index" (3A3h) be carefully consulted as therein all papers, addresses, discussions, reports of committees at conventions and all articles in the *Quarterly* are fully indexed and cross indexed for reference.
 1. "Fire-Prevention: Its Object and Possible Results," C. Heller. (3A3d5.)
 2. "Fire-Prevention Through Adequate Power and Common Sense," C. J. Driscoll. (3A3d5a.)
 3. "Debarment of City Conflagrations," Albert Blauvelt. (3A3d10.)
 4. "Fire-Hazards on the Farm." (3A3d21.)
 5. "Factories and Their Fire-Protection," Franklin H. Wentworth. (3A3d32.)
 6. "Mill Construction Buildings," C. E. Paul. (3A3d32a.)
 7. See, "Planning of School Buildings for Safety," illustrated address by Wm. B. Ittner. "Proceedings" N.F.P.A., 1916.
 8. See, "Summer Hotels, Hazards and Protection," G. Dana. N.F.P.A. *Quarterly*, Vol. 3, No. 2.
 9. See, "Warehouses, Construction and Protection," C. H. Patton. N.F.P.A. "Proceedings," Vol. 14, p. 125.
 10. For "Theatres, Construction and Equipment." See several references in N.F.P.A. "Index" (3A3h).
- (c) See Committee on Fire-Protection, American Society of Mechanical Engineers (4A2).
 1. "Safeguarding Life in Theatres" (a).
 2. "Allowable Heights and Areas for Factory Buildings" (b).
- (d) See Crosby-Fiske-Forster Hand Book of Fire-Protection. (Sixth edition now in preparation.)
 1. "Fireproof Construction."
 2. "Slow-Burning Construction: Recommendations for Mill Construction."
 3. "Improvements for Existing Buildings."
- (e) See "Fire-Prevention and Fire-Protection," Joseph Kendall Freitag.
 1. Slow-Burning or Mill Construction, Chapter IV.
 2. The Materials of Fire-Resisting Construction, Chapter VII.
 3. Permanency and Corrosion, Chapter VIII.
 4. Planning and General Design, Chapter IX.
 5. Efficiency versus Faulty Construction, Chapter X.
 6. Theatres, Chapter XXII.
 7. Schools, Chapter XXIII.
 8. Residences, Chapter XXIV.
 9. Factories, Chapter XXV.
 10. Garages, Chapter XXVI.
 11. Safes, Vaults, Metal Furniture, etc., Chapter XXVII.
- (f) See, also, "The Fireproofing of Steel Buildings," J. K. Freitag.
- (g) See "Kidder's Pocket Book," 1916.
 1. "Wooden Mill and Warehouse Construction," A. P. Stradling, Supt. of Surveys, Philadelphia Fire Underwriters' Association, Chapter XXII.
 2. "Fireproofing of Buildings," Rudolph P. Miller, New York, Chapter XXIII.
 3. "Reinforced Concrete Construction," Rudolph P. Miller, Chapter XXIV.
 4. "Reinforced Concrete Factory and Mill Construction," Emile G. Perot, Chapter XXV.
- (h) See "Trautwine's Civil Engineers' Pocket Book" for general notes and details of construction and for "Price List and Business Directory."
- (j) For all forms of concrete construction see "Concrete," Trautwine. 1916. Reprinted from "Trautwine's Civil Engineers' Pocket-Book."
- (k) See "Building Construction and Superintendence," F. E. Kidder, Part 1, Masons' Work.
 1. "Fireproofing of Buildings," Thomas Nolan, Chapter IX.
 2. "Concrete and Reinforced Concrete Construction," Thomas Nolan, Chapter X.
 3. "Form of Specifications (for all parts of a building)," Chapter XIII.
- (l) "Plain and Reinforced Concrete," F. E. Turneaure. Being Section 5 in "American Civil Engineers' Pocket-Book," M. Merri-man.
- (m) See "Mechanical Engineers' Hand Book, 1916," Lionel S. Marks.
 1. "Building Construction," Lionel S. Marks, pp. 1264-1304.
 2. "Reinforced-Concrete Construction," Sanford E. Thompson, pp. 1305-1316.
 3. "Industrial Buildings," Charles Day, pp. 1317-1333.
- (n) "Reinforced-Concrete Construction," Geo. A. Hool, Vols. 1 and 2.
- (o) "Concrete, Plain and Reinforced," Taylor and Thompson. Revision just out.
- (p) For notes and tables on walls, floors, columns, and other data, see "Mechanical Engineers' Pocket-Book," William Kent. Pages 1385-1394, "Construction of Buildings."
- (q) See Building Trades Hand Book.
 1. Fireproofing.
 2. Metal Furring and Lathing.
- (r) See, "The Architect and Fire-Protection," address by I. K. Pond. N.F.P.A. "Proceedings," Vol. 14, p. 117.
- (s) See, "The Architect and the Fire Waste," C. M. Goddard. N. F. P. A. *Quarterly*, Vol. 5, No. 4.
- (t) Read "The Status of Schoolhouse Construction in the United States," address by Frank Irving Cooper. N.F.P.A. "Proceedings," Vol. 19, p. 102; also an address by him before the fifth congress of the American School Hygiene Association entitled "Schoolhouses and the Law." Contains statistics on various requirements for construction and fire-protection.
- (u) See "Fireproof Building, Its Advantages and Its Weaknesses," H. W. Forster. N.F.P.A. *Quarterly*, Vol. 7, No. 4.
- (v) See "Fireproof Construction, What It Is and What It Ought to Be," E. T. Cairns. N.F.P.A. *Quarterly*, Vol. 7, No. 1.
- (w) "Fire-Resistive versus Fireproof," N.F.P.A. "Proceedings," Vol. 8, p. 235, and *Quarterly*, Vol. 3, No. 4.
- (x) For "Fire-Retardant Materials," see N.F.P.A. "Index," 3A3h.
- (y) "Requirements for Standard Mill Constructed Building," see N.F.P.A. "Proceedings," Vol. 12, p. 103, and Vol. 21, 1917.
- (z) See "Concrete Construction for Mill Buildings," illustrated paper read before The National Association of Cotton Manufacturers, April, 1915, by Leonard C. Wason.

- (aa) See "Proceedings" of the A.S.T.M., Vol. XVI, Part 1 (1A4a).
1. Report of Committee D7 on Timber.
 2. Report of Committee C11 on Gypsum and Gypsum Products.
- (bb) For further references to Gypsum in Building Construction, see:
1. Reports by Underwriters' Laboratories on "Calcination Test on Gypsum Blocks," "Gypsum Block for Fireproof Partitions," also, "Inspected Mechanical Appliances," 3A6b.
 2. See, also, Bureau of Standards, Pittsburgh, Tests on Gypsum Fireproof Partitions.
 3. See, also, Report on Strength and Flexure Tests on Struc-tolite made at Columbia University.
 4. See References under 4B2g and 4D1h 1 and 2.
 5. For descriptive list of Products of the United States Gypsum Co. and Specifications for "Pyrobar" Gypsum Partition Tile, see Industrial Section, p. 205.
- (cc) See the following publications of the Portland Cement Association (1E2).
1. "Factories and Warehouses of Concrete" (1E5n).
 2. "The Concrete House and its Construction" (1E5o). Price \$1, postpaid.
 3. "Concrete Houses and Why to Build Them."
 4. "Fundamentals of Reinforced Concrete Design."
 5. "Recommended Specifications for Reinforced Concrete Design."
 6. "Concrete Schoolhouses."
 7. "Small Concrete Garages."
- (dd) See "Fire-Prevention," Joseph McKeon, 1912.
- (ee) See the writings variously published of Ex-Chief William Croker and of Charles T. Main on fire-prevention and -protection in relation to building construction.
- (ff) This list would not be complete without making reference to the writings and publications of that pioneer spirit, Edward Atkinson, valuable for their significance in the development of sounder building construction.
- (gg) See "Official Record" of the First American National Fire-Prevention Convention, Philadelphia, 1913, containing papers and discussions, among others on Building Construction, Building Codes, Protection Equipment and Insurance.
- The grading of lumber, preservation of wood and all other matters in connection with the use of wood in construction will be treated in later serial number.
- (hh) For further information of interest, applicable to subjects under this heading, see pages in the Industrial Section, as follows:
1. Engineering services in connection with reinforced concrete structures, p. 197, Corrugated Bar Co.
 2. Suggestions in connection with Industrial Buildings, the publication of the Atlas Portland Cement Co. described on pp. 198, 199.
 3. Hollow Tile Fireproofing, p. 208, O. W. Ketcham.
 5. To Govern the Construction and Operation of Laundries (3A4c5).
- (c) National Fire Protection Association:
1. Field Practice. Inspection Manual. See description 3A3d1.
 2. Office Building, Grade A—Specifications for Construction of (3A3d31a).
 3. Structural Defects—Suggestions for Their Elimination and Protection. (Particularly with reference to safeguarding existing features.) (3A3d31b.)
 4. Uses of Wood in Building Construction. Committee Report. Data of tests on inflammability of untreated wood and of wood treated with fire-retarding compounds. 55 pp., illustrated. (3A3d36.)
 5. Dwelling-House Hazards—How to Prevent Fires in the Home. 4 pp., illustrated. (3A3e1.)
 6. Schoolhouses, Fire-Protection of. 16 pp., illustrated. (3A3e4.)
 7. Cold-Storage Warehouses—Suggestions for Their Improvement as Fire-Risks. Committee Report. (3A3d44.)
 8. Shoe Factories. Suggestions for Their Improvement as Fire-Risks. Committee Report. (3A3d42.)
 9. Tanneries. Suggestions for Their Improvement as Fire-Risks. Committee Report. (3A3d41.)
 10. Fire-Prevention Work in Small Cities and Towns. Committee Report. (3A3d9.)
 11. For Report of the Committee on Fire-Resistive Construction, see "Proceedings," 1915, p. 93, with Recommendations for Construction of Private Residences (with Full, Partial and Temporary Protection); also Recommendations for Construction of Places of Amusement (Theatres and Opera Houses, Assembly Halls, Motion Picture Halls, Pavilions, Exposition and Fair Buildings, etc.).
- (d) Inspection Department, Associated Factory Mutual Fire Insurance Companies:
1. Dry Rot in Factory Timbers. 107 pp. with many illustrations showing also diagrams of standard slow-burning mill and factory construction and with suggested forms of specifications for special grades of long-leaf and southern pine (3A6a45).
 2. Fires in Cotton Mills. (3A6a12.)
- (e) New York Chapter A.I.A. and the New York Board of Fire Underwriters:
1. General Information Regarding Fire Insurance Requirements with Particular Reference to Fire-Prevention. Pamphlet. 1914.
- (f) The International Association of Fire Engineers:
1. The safeguarding of Existing School Buildings against Fire. See Report of Committee to recent convention published in *School Board Journal*, Feb., 1917. 3 pp.
- (g) The American Society for Testing Materials (1A4):
1. Tentative Standard definitions of Terms relating to the Gypsum Industry, Serial Designation (C11, 16f).
- (h) The Associated Metal Lath Manufacturers:
1. See Metal Lath Handbook (3C11a) for general details of building construction with this material (and plaster) carefully worked out and figured; includes a standard diagram for a motion picture booth.
- (j) National Lumber Manufacturers' Association, Engineering Bureau (Serial No. 5):
1. Heavy Timber Mill Construction Buildings. This contains also a chapter describing Standard Mill Construction as mentioned under 4B3g1.
- (k) See the publications of the Portland Cement Association referred to under 4B1cc in many of which will be found descriptive and diagrammatic recommendations pertaining to the construction covered by the title.
- (m) See "Natco Hollow Tile Fireproofing as Used in the Construction of Standard Steel Frame Fireproof Buildings."

4B2 Practice Recommended and Suggested by

- (a) U. S. Bureau of Mines: 1. Technical Paper No. 18 (2A3c), "Magazines and Thaw Houses for Explosives." 34 pp. text, data and diagrams.
- (b) National Board of Fire Underwriters:
- See all four of the "Suggested Codes" listed under 3A4d.
1. "Building Code" 3A4d1 (see description by Mr. Woolson under 3A4), will be found to offer invaluable suggestions and assistance on all features of construction both generally and specifically. In addition to buildings in general and all parts of their construction, the following are separately treated:
 - (a) Construction and Equipment of Theatres, illustrated, Part XXXI.
 - (b) Construction of Moving Picture Theatres Having Capacity of Three Hundred or Less. Part XXXII.
 - (c) Assembly Halls: Requirements for Public Safety. Part XXXIII.
 - (d) Tenement-House Law. Part XXXVIII.
 2. "Dwelling Houses" 3A4d3 (see description by Mr. Woolson under 3A4), contains concise and explicit recommendations on all forms of residence construction, including:
 - (a) General Discussion of Defective Construction and Its Relation to Their Fire-Hazard.
 - (b) Quality of Materials Suitable for Construction Work.
 - (c) Major Structural Requirements to Protect Life and Prevent Spread of Fire.
 - (d) Fire-Stopping.
 - (e) Concrete Construction.
 - (f) General Precautions for Fire-Protection.
 3. To Regulate the Installation, Operation and Maintenance of Motion Picture Machines and the Construction and Arrangement of Picture Booths and Audience Rooms (3A4c1).
 4. To Regulate the Construction and Equipment of Theatres (3A4c6).

4B3 Standards Adopted

(a) *Building Codes.* The mandatory provisions of all Codes, state or municipal, must first govern construction in each locality. That these are not always perfect is freely admitted, and it is the duty of all architects, engineers, contractors and owners to coöperate, not only in the fulfilment of all requirements, but in raising the general standard of building construction in every way possible and to take part, as has been done in many localities, in movements to improve existing codes or portions thereof. On this point the Institute, in its Document 107 (1A8b), says:

"An architect should be mindful of the public welfare and should participate in those movements for public betterment in which his special training and experience qualify him to act. He should not, even under his client's instructions, engage in or encourage any practices contrary to law or hostile to the public interest; for as he is not obliged to accept a given piece of work, he cannot, by urging that he has but followed his

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client's instructions, escape the condemnation attaching to his acts. An architect should support all public officials who have charge of building in the rightful performance of their legal duties. He should carefully comply with all building laws and regulations, and if any such appear to him unwise or unfair, he should endeavor to have them altered."

Without referring specifically to various other localities where notable activities obtain with respect to the improvement in and standardization of Building Codes, it is suggested that, as an example of the latest printed word on this important subject, the Building Code of New York City, March 14, 1916, be read, and that its development, through changes officially adopted, be followed. Bulletins giving these changes will be sent to those who register requests for the same. State-wide codes have been adopted in whole by Wisconsin and in part by Ohio. Tentative codes have been prepared by the Commonwealths of Massachusetts, Pennsylvania, and Illinois, through commissions created for this purpose, and printed drafts of these codes have been distributed for comment and criticism preparatory to possible final adoption by the legislative bodies of each of these states.

A bill has just been prepared by the New York State Association of Architects asking for a commission to consider the "desirability and necessity" of a Building Code for that state. (See 4J2.)

See "Practice Recommended and Suggested by:" 4B2b, for reference to the Building Code recommended by the National Board of Fire Underwriters which is a proposed standard that has been widely distributed and copiously copied throughout the country as well as used in educational institutions and otherwise as described by Mr. Woolson under 3A4.

For progress report on work by the Bureau of Standards with respect to Building Codes, see Progress and Current Activities 4J.

For progress report and valuable suggestions, see report of Institute's Committee on Basic Building Code in "Proceedings" of 1916 Convention (1A87).

- (b) By the National Fire Protection Association:
 - 1. Specifications for Construction of a Standard Building (3A3d31).
- (c) By the National Board of Fire Underwriters (recommended by the N.F.P.A.):
 - 1. Vaults, specifications for. Intended for banks, trust companies and others having large values to protect. Drawn primarily from the point of view of fire-protection, but many of the provisions have a bearing on protection against burglary. (3A3a24).
 - 2. Hose Houses for mill yards, construction and equipment (3A3a13).
- (d) By Inspection Department, Associated Factory Mutual Fire Insurance Companies:
 - 1. See 4B2d1 for small illustrations and brief reference to standard, mill and factory construction.
- (e) By Joint Committee on Concrete and Reinforced Concrete:
 - 1. See Report of the Committee 1E7b.
- (f) By American Society for Testing Materials (1A4c):
 - 1. Standard Definitions of Terms Relating to Structural Timber. Serial Designation D9-15.
- (g) By Associated Mutual Fire Insurance Companies of New England:
 - 1. "Standard Mill Construction," shown in Report V, issued by the Insurance Engineering Experiment Station under direction of Boston Manufacturers Mutual Fire Insurance Co. Illustrated and described in Chapter VIII of 4B2j1. Report now obtainable from the Associated Factory Mutual Fire Insurance Companies (3A7c), by whom the work of the Experiment Station has been taken over.
- (h) See all references in N.F.P.A. "Index" to "Uniform Requirements."

Vertical Structural Features

4C Walls, Chimneys and Flues; Columns, Partitions and Enclosures; Doors, Windows and Shutters; Wired Glass and Other Retardents

[NOTE.—For this and all other subdivisions, see, also, the various references under "Reports on Buildings" under Fire 3E and "Buildings and Structures in General," 4B.] See, also, 11D3 and 11D6.

4C1 Information Obtainable

- (a) See particularly all references under Terra Cotta, Hollow Tile and Brick 3D, and Metal Lath, Gypsum, Asbestos and Wired Glass 3D5.
- (b) Wall Construction, Chapter XX of "Fire Prevention and Fire Protection," J. K. Freitag, contains text matter and illustrations on:
 - 1. Openings in walls. 2. Furring of exterior walls. 3. Mullions. 4. Party and fire walls. 5. Wall Columns.
- (c) See, also, in Fire Prevention and Fire Protection" (Freitag):
 - 6. Columns and Column Protections, Chapter XII.
 - 7. Fire-Resisting Partitions, Chapter XIII.
 - 8. Fire-Resisting Shutters, Windows and Doors, Chapter XIV.
 - 9. Elevator Shafts and Enclosures, Pipe Shafts, Chutes, etc., Chapter XVI.
- (d) See various sections of Crosby-Fiske-Forster Hand Book of Fire Protection. (Sixth edition now in preparation.)
- (e) See "Building Construction and Superintendence," F. E. Kidder." Part I, Masons' work.
 - 1. Fireproof Construction, Columns, Partitions, Furring, Chapter IX. Also includes Plaster Block, Hollow Tile and Metal Lath. 2. Lathing and Plastering, Chapter XII. 3. Form of specifications, Chapter XIII.
- (f) See Kidder's Pocket Book, 1916.
 - 1. Various sections relating to Walls. 2. Column Protection, pp. 823-827. 3. Recesses for Pipes, p. 827. This calls attention to Freitag's conclusions that pipes should never be run within fireproofing encasings of columns—which practice is now prohibited in many of our cities.
 - 4. Partitions and Wall Coverings, pp. 878-896.
 - 5. Metal Doors, Windows and Trim, pp. 898-908.
- (g) See "Notes on Leakage of Air Through Windows," Bulletin, Building Data League (2A5d). See, also, 10M.
- (h) For information on the subject of fire-wall divisions in buildings, read Mr. Porter's address mentioned under 4A2d.

- (j) For references to "Fire Protecting Coverings for Window and Door Openings," see N.F.P.A. "Index," 3A3h.
- (k) See, also, Chimneys, Flues and Fireplaces (10H).
- (l) See, Windows, Doors and Metal Trim (11B7); also see 11D3 and 11D6.
- (m) For itemized references to Wire Glass, see 12F2.
- (n) For references to materials and products for consideration in connection with Vertical Structural Features, see pages in the Industrial Section as follows:
 - 1. Architectural Terra Cotta, Atlantic Terra Cotta Co., p. 207; Federal Terra Cotta Co., p. 206; O. W. Ketcham p. 208.
 - 2. Hollow Tile Fireproofing and Face Brick, Hydraulic Press Brick Co., p. 226, O. W. Ketcham, p. 208.
 - 3. Indiana Limestone Quarrymen's Association, p. 145.
 - 4. National Building Granite Quarries Association, p. 201; Webb Pink Granite, p. 202; Presbrey-Coykendall Co., p. 203.
 - 5. Metal Lath and Plaster Construction, pp. 162-167.
 - 6. Information on Evans "Almet" Fire doors and shutters, p. 224, Merchant & Evans Co. Also see notes under 4C3b and c.
 - 7. "A sample of Dahlstrom Service to Architects" and illustration of Hollow Metal Products, p. 219, Dahlstrom Metallic Door Company.
 - 8. For detailed drawings of Bronze Store Front Construction, see p. 209, The Gorham Co.
 - 9. Plans of Dumbwaiter and Elevator Wells, pp. 220, 221, Sedgwick Machine Works.
 - 10. Illustration and description of Glass Enameled Steel Laundry Chute, p. 213. The Pfaudler Co.
 - 11. Mail Chute data, p. 210, Cutler Mail Chute Company. (Also, 11B8.)

4C2 Practice Recommended or Suggested by

[NOTE. See, also, Practice Recommended under Terra Cotta Hollow Tile and Brick 3D, and under Cement and Concrete 1E6.]

- (a) National Board of Fire Underwriters:
 - 1. "Building Code" 3A4d1. Read index to same and see all sections and clauses relating to walls, chimneys and flues, fire-doors, fire-windows, and shutters, protection of vertical openings, mill construction, fireproof construction, and fireproofing.

2. "Dwelling Houses" 3A4d3. Read index to same. In addition to sections mentioned under 4B2b2, there are sections on walls, chimneys, flues and fireplaces.
- (b) National Fire Protection Association:
 1. Read "Index to all Subjects" (3A3h), which is carefully cross-indexed for reference to all subjects under this sub-division.
 2. Examine contents of "Field Practice" (3A3d1).
- (c) Inspection Department Associated Factory Mutual Fire Insurance Companies.
 1. "Beltway Fires, Experience showing the urgent need of, and suggestions for providing non-combustible, sprinkled enclosures for main belts" (3A6a4).
 2. "Prevention of Large Loss in a Mutual Mill," treats of partitions, beltways and protection.
 3. For wood posts in "Mill-Construction" data see "Dry Rot in Factory Timbers" 3A6a45.
- (d) Associated Metal Lath Manufacturers:
 1. For detailed drawings of beltway enclosures and of elevator enclosures, with notes and descriptions, and for drawings of column protections from the Metal Lath Handbook, see Industrial Section, pp. 162-167.
- (e) National Lumber Manufacturers Association, Engineering Department (Serial No. 5) 4B2j1:
 1. Exterior Walls, Fire-Walls and Enclosures, Chapter II.
 2. Posts, or Columns, Chapter IV. (With details of steel post caps.)
 3. See Technical Letters Nos. 4 and 5, August, 1916. "Building Code Suggestions."

4C3 Standards Adopted

- (a) See Specifications for Construction of a Standard Building, N.F.P.A. (3A3d1).
 1. Walls. 2. Piers. 3. Columns. 4. Stair, Elevator and other shafts. 5. Room, Hall and Fire Exit Partitions. 6. Protection of Exterior Wall Openings. 7. Protection of Interior Wall Openings.
- (b) Protection of Openings in Walls and Partitions, N.B.F.U. (3A3a18.)
The full title of this publication is "Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions against Fire. Recommended by the National Fire Protection Association. Edition of 1915."
This deals entirely with the installation of all such protection devices and does not cover the construction. The National Board of Fire Underwriters no longer issues "Rules and Requirements for the Construction and Installation of Fire Doors and Shutters," or "Rules and Requirements for the Manufacture of Wired Glass and the Construction of Frames for Wire and Prism Glass Used as a Fire Retardant." Copies of same in existence should be destroyed.
The Underwriters' Laboratories issues special publications, one entitled "Specifications for Construction of Tin-Clad Fire-Doors and

Shutters" another, "Hollow Metallic Window Frames and Sashes for Wired Glass." These are used as the rules for such construction by the National Board of Fire Underwriters and by most of the local underwriters.

Architects' specifications (unless referring to (e) which follows) should state that tin-clad fire-doors and shutters should be constructed in accordance with the Underwriters' Laboratories' specifications and that they should comply with the rules and requirements of (name the Local Fire Underwriters' Association) and of the City of (name the City). Tin-clad fire-doors and shutters should bear the label of Underwriters' Laboratories as evidence of such compliance or otherwise they must be accepted in writing by the local underwriters' association.

NOTE.—The card quoted as follows is on file with the Editor, but like so many others with which he has come in contact, it bears no date or number or means of identification, except those given by him. After describing the type of door, whether tin-clad, rolling or sliding, steel or metal rolling or sliding and the gauge, make or kind to be considered, the following will apply as:

"SPECIFICATIONS FOR AUTOMATIC FIRE-DOORS TO STANDARD OF NATIONAL BOARD OF FIRE UNDERWRITERS"

All openings in the fire-walls are to be equipped on both sides of each opening with automatic fire-doors, to be released by an automatic release, both doors and release to be approved by, and bear the label of, the Underwriters' Laboratories. The doors are to slide or swing as indicated on the plans, and to be installed with standard approved hardware, in every instance allowing for proper lap. Doors to be adjusted for easy operation after erection."

- (c) See "Vaults" described under 4B3c1.
- (d) "Standard for Counter-balanced Elevator Doors" Underwriters' Laboratories (3A6h).
- (e) "Specifications. Tin Clad Fire Doors and Shutters, 1914." Inspection Department, A.F.M.F.I. Co's. (3A7a 41.)
NOTE. Where "Sheet Metal" doors are used they should be installed to comply with these requirements for tin-clad doors.
- (f) For mechanical appliances and materials inspected and labeled or approved, with names of the articles and manufacturers, see:
 1. List of Inspected Mechanical Appliances (3A6b).
 2. List of Appliances Inspected for Accidents Hazard (3A6d).
 3. Approved Fire-Protection Appliances, Oct. 1916 (3A7a3).
- (g) "Standard Tests for Fireproof Partition Construction," A.S.T.M. (1A4c.) Serial Designation C. 3-09.
- (h) Navy Department specification (3A1a2). "Expanded Metal," Serial Designation 47M1, Aug. 1, 1914.
- (j) For dividing of floor areas, types of partitions, stair enclosures, and other features of industrial buildings, see "Universal Safety Standards," 1914. Compiled under the direction of and approved by the Workmen's Compensation Service Bureau, New York.
- (k) For construction of Elevator Shaftways see "Uniform Regulations for the Construction and Installation of Passenger and Freight Elevators" referred to under 12L22.

4C4 Scuppers, Inserts and Devices

- (a) For these in general see Field Practice, Inspection Manual N.F.P.A. (3A3d1.)
- (b) For description and detail drawings of scuppers see N.F.P.A. *Quarterly* (3A3h), Vol. 4, No. 1. Also see *Quarterly*, Vol. 9, No. 2, and "Proceedings," Vol. 19, p. 483.
- (c) For detail drawings of scuppers see "Watertight Floors of Mill Construction (3A6a26).
- (d) Similar details shown in Chapter III of 4B2j1.

- (e) Other details and description of scuppers, "Kidder's Pocket Book," p. 767.
- (f) For information on scuppers, data as to sizes and requirements relative to floor area, see "Building Code" (3A4d1).
- (g) For suggestions on wall fastening devices see paper with that title read by Carrington McFarland before Society of Constructors of Federal Buildings in Journal (2A4a) for March, 1916.

Horizontal and Sloping Features

4D Beams, Girders and Floors, Ceilings and Roof Construction, Roofs and Roof Coverings (See, also, 11D2, 11D3, and 11D4)

4D1 Information Obtainable

[NOTE. For this and all other sub-divisions, see the various references under Reports on Buildings under Fire, 3E and Buildings and Structures in General, 4B. See, also, references under 3D, and 3D5.]

- (a) See, "Fire Prevention and Fire Protection," J. K. Freitag.
 1. Slow-burning or Mill Construction, description and typical diagrams, Chapter V.
 2. Fire-Resisting Floor Design, Beam and Girder Protections, Ceilings, Chapter XI.
 3. Terra Cotta Floors, Girder-Protections, etc. Chapter XVII.
 4. Concrete Floors and Reinforced Concrete, Chapter XVIII.
 5. Combination Terra-Cotta and Concrete Floors, Chapter XIX.
 6. Roofs, Suspended Ceilings, Furring, Chapter XXI.

- (b) See "Fire Tests of Floors in the United States," Ira H. Woolson and Rudolph P. Miller. A completely illustrated paper giving detailed drawings and descriptions forming a record for the International Association for Testing Materials of all fire-tests obtainable upon all kinds of floors. 1912.
- (c) See various sections of Crosby-Fiske-Forster Hand Book. (Sixth edition in preparation.)
- (d) See Building Construction and Superintendence, F. E. Kidder. Part 1. Masons' Work.
 1. Fireproof Construction—Floors, Roofs, Ceilings, pp. 460-542.
- (e) For much valuable information on suggested construction and floor-load developments, read 1916 progress report of Committee on Basic Building Code A.I.A. (1A8f).
- (f) See "Kidder's Pocket Book, 1916."
 1. Strength and Stiffness of Wooden Floors (with tables of loads for floors and rafters) pp. 717-750.

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2. Fireproof Floor Construction, pp. 827-871, treats of all kinds.
3. Fireproof Roof Construction, pp. 872-878.
4. Fireproof Flooring, pp. 897-898.
5. Asbestos Roofing Shingles, Asbestos Protected Metal and Other Products, p. 819.
- (g) The Bureau of Standards, U. S. A. issued a "Report of Loading Test of a Two Way Reinforced Floor in William A. Hill Apartment Building, Washington, D. C., June 22, 1916," which was referred to the Institute's Committee on Materials and Methods by Leon E. Dessez, then member of the Washington Chapter subcommittee. Consists of 5 pp. typewriting, 2 detailed blueprint sheets, showing combination hollow-tile and reinforced concrete construction.
- (h) Bulletin No. 25 "Public Works of the Navy" under the cognizance of the Bureau of Yards and Docks and the Corps of Civil Engineers, U. S. Navy, Jan., 1917 (Serial No. 8A1) gives:
 1. "Report on Inspection of Installation of Gypsum Slab Construction for Roofs and Floors," Geo. A. McKay, U. S. N.
 2. "Report on Loading Test of a Composition Floor Made by the U. S. Bureau of Standards, Nov. 14, 1916," E. B. Rosa. Illustrated.
- (j) In Journal of the Society of Constructors of Federal Buildings (2A4a) for May, 1915, is an address by Charles F. Hennig describing "Gypsum Plasters" which includes reference to floor-domes and partition-blocks.
- (k) See "Unit System of Wood Flooring for Fireproof Manufacturing Buildings," C. H. Patton, N.F.P.A. *Quarterly*, Vol. 8, No. 1.
- (l) See "Waterproofing Floors," N.F.P.A. *Quarterly*, Vol. 7, No. 4.
- (m) For general information on the subject of composition flooring, see Industrial Section, pp. 174, 175, American Materials Co.
- (n) See "Enclosures for Floor Openings" N.F.P.A. *Quarterly*, Vol. 8, No. 3.
- (o) For "Classification of Roofs and Roofings," see five references in N.F.P.A. "Index" (3A3h).
- (p) See "Asbestos Roofing," N.F.P.A. *Quarterly*, Vol. 6, No. 2.
- (q) See "Roof Covering Tests" N.F.P.A. *Quarterly*, Vol. 4, No. 1, and Vol. 10, No. 4.
- (r) For descriptive matter pertaining to Slate Surfaced Asphalt Shingles, see Industrial Section, p. 172, Certain-teed Products Corporation.
- (c) Inspection Department Associated Factory, Mutual Fire Insurance Companies:
 1. For wooden floor construction data and wooden floors, see "Dry Rot in Factory Timbers" (4B2d1).
 2. For detail drawings and recommendations see "Anchorage of Roofs" (3A6a1).
 3. "Watertight Floors of Mill Construction" (3A6a26) contains also diagrams of flashings against walls and around columns.
- (d) The Associated Metal Lath Manufacturers:
 1. See the illustrations and descriptions from the Metal Lath Handbook shown in the Industrial Section, pp. 162-167, with particular reference to details of construction recommended for Suspended Ceilings and Protection of Mill Construction.
- (e) National Lumber Manufacturers Association Engineering Department. (Serial No. 5) 4B2j1:
 1. Floors, Chapter III. 2. Roofs, Chapter V.
- (f) Portland Cement Association (1E2):
 1. Suggested Specification for Concrete Floors.
- (g) For "Standard Specifications of the North Bangor Slate Company" for flat slate roofs, see Industrial Section, p. 204.
- (h) For suggestions for laying a Tin roof in accordance with Standard Specifications, see Industrial Section, p. 146, N. & G. Taylor Co., "Target and Arrow" Roofing Tin.
- (j) In using the Barrett Specification for roofs and guarantee bond, it is to be noted that the latest specification should be referred to by date, as of May 1, 1916, as explained in circular letter of March 8 from this Company.

4D3 Standards Adopted. (See, also, 11D2 and 11D4)

(Observe also the Standards under Vertical Features, 4C3.)

- (a) See "Specifications for Construction of a Standard Building," N.F.P.A. (3A3d31.)
 1. Floor and Roof Construction. 2. Drainage.
- (b) See, also, "Skylights," listed 3A3a20.
- (c) By the American Society for Testing Materials (1A4c): "Standard Tests for Fireproof Floor Construction," Serial Designation C2-08.
- (d) By the U. S. Navy Department. See "Specifications" (3A1a2):
 1. For "Cement Flooring," Serial designation 59F-1, Aug. 1, 1914.
 2. For "Linoleum," Serial designation 29L1c, Sept. 1, 1916.
 3. For "Copper, Rolled Bars, Plates, Sheets and Shapes," Serial designation 47C2a, Nov. 1, 1915.
 4. For "Zinc Plates, Rolled or Composition," Serial designation 47Z4, Nov. 1, 1913.
 5. For "Felt, Sheathing, Tarred," Serial designation 33F1, Sept. 20, 1912.
 6. For "Slate Roofing" (mentioned under 2K7a).
 7. For "Sheet Rubber Tiling" Serial designation, 59T1a, July 15, 1913.
 8. For "Tinned Plate" Serial designation, 47T1a, Jan. 2, 1915.
- (e) By Building Data League (2A5a):
 1. "Standard Specification" for Concrete Hardeners. Dated Feb. 1, 1917.
 2. "Standard Specification" for Floors, Concrete. Dated Feb. 1, 1917.
 3. "Standard Specification" for Asbestos Shingles. Dated Sept. 23, 1915.
- (f) For mechanical appliances and materials inspected and labeled or approved, with names of the articles and manufacturers, see:
 1. List of Inspected Mechanical Appliances (3A6b). This includes Roof Coverings, Class A, Class B, and Class C, and some thirty-three other materials, and systems. (See, also, 11D2f.)
 2. Approved Fire Protection Appliances, Oct. 1916 (3A6a3)

4D2 Practice Recommended or Suggested by

- (a) National Board of Fire Underwriters:
 1. "Building Code" (3A4d1)
 - (a) Read index to same and see all sections and clauses relating to steel, concrete, and composite floors and roofs and to mill construction, allowable loads.
 - (b) See section on strength test for floor construction and data on slope of floors in mill construction and other floors for drainage of water.
 - (c) See section on skylight construction and all others applicable to this subdivision.
 2. "Dwelling Houses" (3A4d3).
 - (a) Read index to same and see recommendations which are applicable to this subdivision in the various materials described.

In addition to those mentioned under 4B2b2 there is a section on "Floor and Roof Construction" and one on "Horizontal Cut-off for Cellars."
 3. The publication 3A4c8 contains an "Ordinance for Fire-Resistive Roof-coverings."
- (b) National Fire Protection Association:
 - Read "Index to all Subjects" (3A3h) which is carefully cross-indexed for reference to subjects under this subdivision and see particularly Reports of Committees to Conventions published in the Proceedings.

4D4 Floor Hangers, Roof Connections and Devices

(See, also, Scuppers, Inserts and Devices 4C4.) Many of these are included in the various references given under 4D1, 2 and 3, which see.

- (a) For reference to details of steel post-caps, see 4C2e.
- (b) For stirrups and hangers, see "Kidder's Pocket Book," pp. 751-758.
- (c) For hangers, post-caps, and other floor and roof connections, see "Kidder's Pocket Book," pp. 783-800.
- (d) See N.F.P.A. "Index" (3A3h), "Devices and Materials."

4D5 Tanks and Reservoirs

As architects have frequent occasion to specify tanks of steel or wood within, and in connection with buildings for many purposes other than fire-prevention, the

standards are here enumerated which may well be referred to in place of independently specifying the tanks.

1. The "Regulations of the National Board of Fire Underwriters for the Installation of Gravity and Pressure Tanks, Concrete Reservoirs and Valve Pits" (3A323) contain diagrams and standard specifications for wood tanks, frostproof boxing of pipes, steel tanks and supports, reservoirs, tables of capacities, and, throughout constitute valuable and trouble-saving standards to follow.

2. The same applies to the standard specifications of the Inspection Department Associated Factory Mutual Fire Insurance Companies, "Gravity Tanks and Towers" (3A614).
3. See, also, "Elevated Tanks, Their Improved Design and Construction," N.F.P.A. (3A328.)
4. See, also, "Field Practice" (3A3d1) for installation suggestions.
5. See, also, "Building Code," N.B.F.U. (3A4d1.) Pp. 105, 195.

4E Exits—Stairways and Fire-Escapes; Safety to Life; Slipping Hazards

(See, also, 11B14 and 12F2 and 12J)

4E1 Information Obtainable

- (a) For valuable statistics on the movement of crowds of people on stairways and ramps, and for calculations used in proportioning areas and exits in connection with the planning of the Hudson Terminal Buildings, see paper "A Terminal Station," by J. V. Davies and J. H. Wells, read at Convention of the American Institute of Architects, 1909, and published, with other papers, in separate form, from the Proceedings of that year under the title "The Relations of Railways to City Development."
- (b) For "Entrance and Exit Calculations" see Proceedings N.F.P.A., Vol. 15, p. 257.
- (c) See "Life Hazards in Crowded Buildings Due to Inadequate Exits," H. F. J. Porter. Described under 4A2d.
- (d) See "Planning School Buildings for Safety," C. B. J. Snyder. Address before N.F.P.A., 1916. Proceedings, Vol. 20, p. 95.
- (e) See "Fire Danger in Schoolhouses," with illustrations and descriptions of stairs, and exits, furnished through Russell Sage Foundation, Safety Engineering, Vonnegut Hardware Co., and C. B. J. Snyder, by Miss May Ayres and F. I. Cooper. Reprinted from *American School Board Journal*.
- (f) See description of "Philadelphia Fire Escape Tower," N.F.P.A. *Quarterly*, Vol. 4, No. 4.
- (g) For "Fire Escapes," see N.F.P.A. "Index" (3A3h).
- (h) See "Kidder's Pocket Book," 1916. Doors and Stairways, with Table of Treads and Risers," pp. 1565-1568.
- (j) See Ditto "Tower for Stairways, Elevators, etc.," p. 768.
- (k) See "Fire Prevention and Fire Protection," J. K. Freitag.
 1. Stairways and Fire-escapes, Chapter XV.
 2. Fire Drills, Chapter XXXVII.
- (l) See Crosby-Fiske-Forster Hand Book of Fire-Protection (sixth edition in preparation), many sections of which are devoted to these subjects specifically.
- (m) See "Planning the Schoolhouse against the Fire-Hazard," reprinted from *Better Schools Magazine*, Dec., 1915, F. I. Cooper and H. F. J. Porter, 8-page pamphlet with suggestions for state regulation.
- (n) See "Mechanical Engineers Hand Book, 1916," Lionel S. Marks; "Prevention of Accidents," D. S. Beyer, pp. 1382-1389.
- (o) For papers, discussions and resolutions on "Fire Escapes," "Life Hazards," "Standards," and other subjects bearing on this subdivision (and others), see "Official Record of the First American National Fire-Prevention Convention." Philadelphia, Oct. 13-18, 1913. 541 pp.
- (p) For information on Von Duprin Self-Releasing Fire Exit Latches, see Industrial Section, p. 147, Vonnegut Hardware Company.

4E2 Practice Recommended and Suggested by

- (a) National Fire Protection Association:
 1. Attention naturally centers upon the important work of the Committee on Safety to Life. The reports of this Committee and discussions printed in the 1914, 1915, and 1916 Proceedings should be carefully read by everyone planning urban or other buildings in which people congregate.

This Committee was created in June, 1913, and empowered to consider advisable modifications of the Association's standards in order to provide for safety to life, additional standards on safety to life with particular reference to exit facilities and housekeeping methods, and to consider coöperation, respecting accidents through fire, with existing bodies organized to study industrial or other accident prevention.

4F Fittings, Contents and Protection Equipment

(See, also, "Sprinklers and Fire-Protection," 9K)

4F1 Information Obtainable

- (a) The U. S. Bureau of Mines, 2A3c, has published, 1915, Technical Paper No. 127, "Hazards in Handling Gasoline."

The personnel of the Committee makes it representative of these coöperative interests, including the National Safety Council, which will be mentioned in another serial number, and the Workmen's Compensation Service Bureau, reference to which is made herein.

Perusal of the reports will disclose recommendations, calculations, statistics and other data of great value and helpfulness in the planning of all types of buildings. These include:

- (a) Escapes, stairs, balconies, chutes, and poles.
- (b) Location, access, material, and strength.
- (c) Number of occupants based on exit capacity.
- (d) Stair capacity, with calculations and tables.
- (e) Exits based on area.
- (f) Horizontal openings; vertical openings.
- (g) Report on outside stairs: 8 pages of descriptions and with recommendations concerning various types, heights of buildings with specifications and illustrations; 9 pages of discussion.

[NOTE.—This report is published separately and listed 3H3d15.]

- (h) Sprinklers as life-savers.
- (j) Stair requirements for buildings.
- (k) Exit capacity schedule (Massachusetts Rating and Inspection Bureau).
- (l) Proposed capacity in number of persons per unit of stair-width.
- (m) Classification of occupancies.
2. See also "Exit Drills for Factories, Schools, Department Stores and Theatres" (3H3d16).
3. Also "Fire Protection in Schools" in which are illustrations of smokeproof school stairway with wired glass in metal frames, plans, diagrams and rules of the New York Board of Education for safeguarding lives of school-children (3A3e4).
- (b) National Board of Fire Underwriters:
 1. "Building Code" (3A4d1). Read index to same for all sections applicable.
 2. "Dwelling Houses" (3A4d3). See all sections applicable including "Necessity for Secondary Exits" and "Structural Requirements for Protecting Stairways and Shafts."
- (c) In connection with the slipping hazard:

See data on "Faralun" Anti-Slip Treads, with sectional drawings and "model specification," of the American Abrasive Metals Co., in Industrial Section, p. 168.
- (d) In connection with safety to life:

See pp. 180-183 in Industrial Section, National Automatic Sprinkler Association.

4E3 Standards Adopted

- (a) See Building Code, New York City, referred to under 4B3a.
- (b) See Building Code, City of Philadelphia, with provision for the original smokeproof tower.
- (c) See "Specifications for the Construction of a Standard Building," N.F.P.A. (3A3d31).
 1. Stairways and Smokeproof Towers.
- (d) See "Universal Safety Standards" (Workmen's Compensation Service Bureau, New York) for diagrams of stairways, exits, fire-escapes and runways.
- (e) Navy Department Specification (3A1a2) "Safety Treads," Serial Designation 12T4a, March 1, 1916.
- (f) List of Appliances Inspected for Accident Hazard (3A6d).

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3. Automatic Fire Alarms and Sprinkler Alarm and Supervisory Systems, Chapter XXXI.
 4. Simple Protective Devices, Fire-Pails and Extinguishers Paints and Solutions, Chapter XXXII.
 5. Watchmen, Watch-Clocks and Manuals, Chapter XXXIII.
 6. Standpipes, Hose-racks and Roof-nozzles, Chapter XXXIV.
 7. Inspection and maintenance of Fire-Protective Devices, Chapter XXXVI.
- (c) The new Edition (sixth in preparation) of the Crosby-Fiske-Forster Hand Book of Fire-Protection will be found replete with data, statistics, and suggestions pertaining to these subjects.
- (d) Interesting automatic fire-alarm systems for the detection of fire have been devised and should be given consideration in connection with the installation of protection equipment in buildings.
- (e) For "Sprinkler System and Heating, Combined," see N.F.P.A. *Quarterly*, Vol. 6, No. 3.
- (f) The subject of the relative corrosion of iron and steel pipe will always engage the attention of those responsible for sprinkler and other installations. This subject will be more fully treated in later serial numbers when under heating and plumbing the investigations and reports of the American Society of Heating and Ventilating Engineers and of the American Society of Mechanical Engineers and others are mentioned. Meanwhile the following will be found of interest in connection with sprinkler work:
1. "Corrosion of Automatic Sprinklers," N.F.P.A. *Quarterly*, Vol. 4, No. 2.
 2. "Corrosion of Automatic Sprinklers," N.F.P.A. "Proceedings," Vol. 4 and Vol. 6.
 3. "Relative Corrosion of Iron and Steel Pipe as Found in Service," Wm. H. Walker, N.F.P.A. *Quarterly*, Vol. 6, No. 3.
 4. "Standardization of Pipe and Pipe Fittings," progress report of Committee, N.F.P.A. "Proceedings," Vol. 19.
 5. For other information on the subject of pipe and piping, see N.F.P.A. "Index" and read Reports of Committees on Automatic Sprinklers in various "Proceedings."
- (g) See "Mechanical Engineers Pocket Book," Lionel S. Marks.
1. "Corrosion of Pipes, Boilers and Structural Work," pp. 556-562.
 2. "Fire Protection," H. O. Lacount, pp. 1390-1393.
- (h) See "Mechanical Engineers Pocket Book," Wm. Kent, for data on all kinds of pipe.
- (j) Concerning Underground Piping for Sprinkler Installation, see 9K1.
- (k) For information on Sprinkler Equipments in general see National Automatic Sprinkler Association, (4A3) and Industrial Section, pp. 180-183, by Information Service Department of same.
- (l) For references to wrought iron pipe, and to publications of A.M. Byers Company, see Industrial Section p. 225.
- (m) For references to cast iron pipe, see Industrial Section, pp. 222-223, Cast Iron Soil Pipe Makers Association.

4F2 Practice Recommended or Suggested

- (a) By the National Fire Protection Association:
The work of certain of the committees should be followed and the reports and discussions printed in the "Proceedings" should be read for all matters pertaining to the Fittings, Contents, and Protection Equipment of Buildings. This is particularly the case with the following committees:
1. On Safety to Life (see 4E2a).
 2. On Field Practice (see publication "Field Practice" 3A3d1).
 3. On Manufacturing Risks and Special Hazards.
 4. On Automatic Sprinklers.
- There are other committees concerned with various technical and engineering subjects, and the features of the work of all of these committees of especial significance at the time of need for reference may be ascertained through the N.F.P.A. "Index to Subjects" (3A3b).
5. For discussions on occupancy of buildings and recommendations for licensing, see "Proceedings," 1916, pp. 195-201.
- (b) By the National Board of Fire Underwriters:
1. See "Building Code" 3A4d1, and read classified Index.
2. Read "Dwelling Houses" 3A4d3 and its Index.
- (c) By the American Society for Testing Materials 1A4a:
1. Tentative specifications for 2½-, 3- and 3½-inch double-jacketed cotton rubber-lined fire hose for public fire department use.
2. Tentative tests for cotton fabrics for use in hose, belting and similar articles.
- (d) By the Workmen's Compensation Service Bureau:

1. See "Universal Safety Standards." A reference book of Rules, Drawings, Tables, Formulae, Data and Suggestions with particular reference to Occupancy, Fittings and Protection Equipment in Industrial Buildings.

- (e) For detailed drawings of metal wainscoting and shelving prepared by Dahlstrom Metallic Door Company, and reference to other Hollow Metal Products, see Industrial Section, 219.

4F3 Standards Adopted

- (a) By the U. S. Navy Department:
The Navy Department issues specifications in large number for many kinds of materials, installations, extinguishers and other apparatus and devices. These include specifications for iron, steel and wood and their protection, for mechanical systems and appurtenances and for metal furniture and lockers—all of which are of interest and value in connection with fire-prevention, and -protection in buildings and their equipment. Read the "Index to Specifications" (3A1a1), for titles and Navy Department serial numbers.
- (b) By the National Fire Protection Association:
See Specifications for the Construction of a Standard Building (3A3d31).
1. Protection of Exterior Wall Openings.
 2. Protection of Interior Wall Openings.
 3. Service Equipment.
- (c) By the National Board of Fire Underwriters, which have been adopted by and are also distributed by the National Fire Protection Association:
1. See "Vaults" referred to under 4B3b1.
 2. "Sprinkler Equipments—Automatic and Open Systems" (3A3a21).
 3. "Fire Pumps (Steam)" (3A3a7).
 4. "Fire Pumps, Rotary and Centrifugal, and Electrical Driving of Fire Pumps" (3A3a8).
 5. "Steam Pump Governors and Auxiliary Pumps" (3A3a22).
 6. "Signaling Systems Used for the Transmission of Signals Affecting the Fire Hazard" (3A3a19).
 7. "Tanks (Gravity and Pressure), Concrete Reservoirs and Valve Pits" (3A3a23).
- (See other publications on specialized subjects in lists of publications.)
- (d) By Inspection Department, Associated Factory Mutual Fire Insurance Companies:
1. "Rules for Installing Sprinkler Equipments," 1911 (3A7a16).
The following is taken from "Approved Fire-Protection Appliances" (3A7a3), Oct., 1916, which see for all appliances or materials stipulated as approved:
"Before a sprinkler equipment, either wet or dry pipe, is put in, or before a present sprinkler equipment is remodeled, complete working plans of the piping should be sent to the insurance companies.
"The plans will be cheerfully examined, criticized, or approved free of charge. This avoids subsequent expensive changes and secures the benefit of latest experience. Only the plans of the successful bidder should be sent for approval."
 2. "Specifications for Rotary and Centrifugal Fire Pumps," 1912 (3A7a20).
 3. "Specifications for Underwriter Steam Fire Pumps," 1911 (3A7a24).
 4. "Rules for Dry Pipe Systems of Automatic Sprinklers," 1912 (3A7a8).
 5. "Specifications for Fire Hose, Play-Pipes and Hose-Houses" 1911 (3A7a10). Purchasers of cotton rubber-lined and unlined linen hose are advised to insist on the guarantee given in the specifications on inside of front cover.
"For outside service the 2½-inch cotton rubber-lined hose should be used, and for inside the unlined linen, the 2¼-inch for standpipe work and the 1¼-inch for small-hose equipment."
 6. "Specifications for Valves, Indicator Posts and Hydrants," 1914 (3A7a25).
 7. "Specifications for Gravity Tanks and Towers," 1913, (3A7a14).
(See other publications on specialized subjects in list of publications.)
- (e) By the American Society for Testing Materials 1A4a, "Standard Specifications for Welded Steel and Wrought-Iron Pipe." Serial Designation A 53-15.
- (f) By Underwriters' Laboratories:
For mechanical appliances and materials inspected and labeled with names of the articles and manufacturers, see "List of Inspected Mechanical Appliances" (3A6b).

4C Lightning Protection

4C1 Information Obtainable

(a) In an address by the then Architect of Farm Structures in the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, entitled "Architectural Problems of the Farmhouse," delivered before the American Society of Agricultural Engineers, in December, 1914, it was pointed out:

That the necessity for and desirability of lightning protection is affirmed by scientists and confirmed by experience. Statistics compiled by fire marshals were quoted to show the infinitesimal proportion of loss in different states of rodded buildings compared to those without lightning protection.

That in Illinois there was no loss whatever from rodded buildings during the previous year and \$1,104,693 for buildings not rodded.

That in the instances when an examination was made, it was found that the rods were not properly placed or that, as in one instance, they had been in service thirty years without repair.

It was also stated that farmers' mutual insurance companies, after keeping records of the losses from lightning in both rodded and unrodded buildings, were making substantial reductions in rates for rodded buildings, and that several companies were refusing to insure buildings not provided with this protection.

(b) In a paper by Ernst J. Berg, Professor of Electrical Engineering, University of Illinois, read before the Illinois State Electrical Association in 1912, he stated that "to people living in cities the lightning protection of buildings is of little or no interest, as the extensive network of wires, metal roofs, etc., are usually ample for protection. The man living in the country, however, is very much concerned, as experience has shown that in certain localities, at least, it is indeed tempting Providence not to have some lightning-rod scheme."

(c) In the Price Current-Grain Reporter, Dec. 23, 1914, it was stated that the Mutual Fire Prevention Bureau of Oxford, Mich., quotes data on 15,000 farm buildings all over the country, which have been compiled by Prof. J. Warren Smith of the U. S. Weather Bureau, Columbus, Ohio. Thirty-three per cent of 5,000 of the buildings were rodded. Of the total of 15,000 buildings, 1,089 were struck and 250 burned. Out of the 5,000 rodded buildings, 37 were damaged and 6 wholly burned. Of the 10,000 unrodded buildings, 10 per cent were struck and 2½ per cent burned. Of the 5,000 rodded buildings, ¾ of 1 per cent was damaged and ¾ of 1 per cent burned.

The same Bureau also states: "One insurance company in Illinois had never paid a loss on a rodded building and had seven million dollars' insurance in force. The calculated efficiency of rods in Michigan is 99.9 per cent; Iowa, 98.7 per cent; Ontario, Canada, 94 per cent; and in Mississippi, 99 per cent. These facts certainly prove that lightning rods do protect when properly installed. A system of rods not properly grounded is no better than no rod at all. It is not out of place to assume that a large number of the losses on rodded buildings was due to the system being out of repair. This is something on which we have no data."

(d) "Protection of Buildings from Lightning," A. R. Sawyer and L. J. Smith, August, 1907. Michigan State Experiment Station, Agricultural College, Mich., Bulletin No. 249, 35 pages, illustrated.

(e) "Preventable Fires, Increasing Farm Hazards Due to Modern Conditions," Chas. E. Campbell, in the *Country Gentleman*, March 15, 1913, p. 431. Curtis Publishing Co., Philadelphia. Discusses particularly the lightning risks of barns and the advisability of separating the hay-barn from the general farm-barn.

(f) "Lightning and Lightning Conductors," J. Warren Smith, Professor of Meteorology, Columbus, Ohio. "Proceedings and Papers of the Nineteenth Annual Meeting of the National Association of Mutual Insurance Companies," Columbus, Ohio, 1914, pp. 23-42. Harry P. Cooper, Secretary, Crawfordsville, Ind. Also printed separately. Contains many statistics and also instructions for protecting buildings.

(g) "Lightning Loss and Damage, and Lightning Protection," Prof. W. H. Day, March, 1914. Ontario Agricultural College, Toronto, Canada, Bulletin No. 220. Lightning statistics gathered in Ontario, Iowa and Michigan.

(h) "Protecting Buildings against Lightning," George H. Armstrong. The functions and effectiveness of the lightning rod considered in the light of modern theory and practice. *Electrical World*, New York, August 21, 1915, pp. 402-406, illustrated by 14 figures.

(j) "The Use of Metal Conductors to Protect Buildings from Lightning," E. W. Kellogg, Missouri University Engineering Experiment Station, Columbia, Mo., Vol. 3, No. 1.

(k) "Practical Talks on Farm Engineering," handbook by R. P. Clarkson. Doubleday, Page & Co., New York. Contains short article on the use of barbed wire for lightning rods for protecting farm buildings.

4C2 Practice Recommended or Suggested by

(a) The U. S. Bureau of Standards issued, 1915, Technologic Paper No. 56, O. S. Peters (1A2c), "Protection of Life and Property Against Lightning." This contains important evidence of the value of lightning-rod protection and a comprehensive discussion of the entire subject.

(b) The U. S. Department of Agriculture, published, 1909, Farmers' Bulletin No. 367, "Lightning and Lightning Conductors," by Alfred J. Henry, illustrated, which is now being revised and brought up to date by R. N. Covert, of the Weather Bureau, under the title "Modern Methods of Protection against Lightning."

(c) The National Fire Protection Association:

See references to Committee Reports in "Proceedings" N.F.P.A., Vol. 8, p. 251; Vol. 9, p. 271; Vol. 10, p. 264; Vol. 17, p. 263, and especially the very complete Report of the Committee on Signaling Systems in Vol. 20 (1916). This contains 26 pages of descriptive text and discussions, is fully illustrated with details and diagrams, and is prefaced with this explanation by the Chairman, Ralph Sweetland.

"This Association once published a pamphlet entitled 'Suggestions for Protection against Lightning,' which was the result of a considerable amount of work and investigation and study of theoretical considerations which had been found expressed in various governmental publications here and abroad. It served a useful purpose for some time, but with the development of the art and the extension of the application of lightning rods in this country following the American practice, it appeared desirable to revise this pamphlet. Through the Underwriters' Laboratories and through committees, a large amount of work was done in conference with manufacturers of lightning rods, the U. S. Bureau of Standards and other organizations, looking toward the development of a standard of practice in lightning-rod work and an investigation of public opinion in regard to the effectiveness of lightning rods in general. As a result the Signaling Committee has collected and presents in this report the essential results of those efforts. The report, however, gives a general discussion of the theory and goes into the question of the installation of lightning rods; how they should be put on buildings, how the grounds should be made, and similar installation matters.

"The subject is one on which there is a wide difference of opinion; one in which there has been a large amount of investigation, a great deal of theory and some practice. The investigations of the last two or three years have shown the development of a very excellent practice in lightning-rod work and have thoroughly established in the minds of the Committee the opinion that the rather widely prevalent and popular idea that lightning rods are out of date and worthless and unimportant is wholly incorrect, and that lightning rods are an important, valuable and essential part of fire-protection engineering work in very many locations, when properly made, installed and maintained.

"I think we may say that the recommendations as to practice now presented afford one of the first, if not the first, practical and commercially feasible presentations of how to do it. This has been developed and worked out with the very liberal and very widespread cooperation of the lightning-rod manufacturers with this Committee and with Underwriters' Laboratories.

(d) The National Board of Fire Underwriters issues "Suggestions for Protection against Lightning" as recommended by the National Fire Protection Association, 1916 (3A3415).

(e) The Underwriters' Laboratories:

1. See "Standard (Tentative) for the Construction and Installation of Materials for Lightning-Rod Equipments" (3A6k).

2. The "List of Inspected Electrical Appliances" published semi-annually by the Underwriters' Laboratories, contains a list of manufacturers of materials for lightning-rod equipment whose standard products are regularly inspected at the factories and labeled under the Laboratories' service.

4H Fire Insurance

1. The following clauses constitute Article 21 of the Standard Documents of the American Institute of Architects (1A8g):

Art. 21. *Fire Insurance.*—The Owner shall effect and maintain fire insurance upon the entire structure on which the work of this contract is to be done and upon all materials, tools and appliances in or adjacent thereto and intended for use thereon, to at least 80 per cent of the

insurable value thereof. The loss, if any, is to be made adjustable with and payable to the Owner as Trustee for whom it may concern.

All policies shall be open to inspection by the Contractor. If the Owner fails to show them on request or if he fails to effect or maintain insurance as above, the Contractor may insure his own interest and charge the cost thereof to the Owner. If the Contractor is damaged by failure of the Owner to maintain such insurance, he may recover under Art. 39.

If required in writing by any party in interest, the Owner as Trustee

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shall, upon the occurrence of loss, give bond for the proper performance of his duties. He shall deposit any money received from insurance in an account separate from all his other funds, and he shall distribute it in accordance with such agreement as the parties in interest may reach, or under an award of arbitrators appointed, one by the Owner, another by joint action of the other parties in interest, all other procedure being in accordance with Art. 45. If after loss no special agreement is made, repayment of injured work shall be ordered under Art. 24.

The Trustee shall have power to adjust and settle any loss with the insurers unless one of the contractors interested shall object in writing within three working days of the occurrence of loss and thereupon arbitrators shall be chosen as above. The Trustee shall in that case make settlement with the insurers in accordance with the directions of such arbitrators, who shall also, if distribution by arbitration is required, direct such distribution.

2. . . . It is the common experience of owners of buildings which have been damaged or destroyed by fire that, in the adjustment of their insurance, they have been obliged either to forego competent expert advice or to pay the cost of such advice themselves.

Through the efforts of the Louisiana Chapter of the Institute, owners in that section of the country are now generally insisting on the insertion of the following clause in all fire-insurance policies:

4J Progress and Current Activities

1. *The Bureau of Standards and Building Codes:*

The engineering data resulting (from the various investigations now taking place through coöperative work) must serve as the foundation upon which building codes must be constructed. Some progress has been made during the year in compiling the municipal building codes, not alone with a view to furnishing information to state and city building bureaus and to others interested along these lines, but with a view to a comparative study of existing codes to assist in planning a systematic program of investigations to definitely answer the many important questions about which there are still great differences of opinion.

Progress in summarizing the enormous amount of material contained in the many municipal building codes is necessarily slow with the present wholly inadequate force that can be assigned to this work; indeed, it is an endless job. Several capable assistants with a good engineering training and experience, and as many clerks, should be kept on this phase of the work uninterruptedly if reasonable progress is to be made. At the present time, as each city takes up the question of revision of its building code, it expends large sums of money and much time in making a very imperfect summary of a few existing codes—just sufficient to imperfectly serve its immediate needs—with the result that large sums of money have been expended in the past for such work, the results of which are available to nobody. It is evident that this work should be well done once, and thus made generally available. In addition to summarizing American building practice as exemplified in our building codes, the building practice of the most important European cities should be collected and made available to our state and municipal building bureaus when they take up the revision of their own codes.—From Report, 1916, Bureau of Standards.

(2) *The New York State Association of Architects and a State Building Code.*

In a letter to Prof. Thomas Nolan, Chairman of the Institute's Committee on Materials and Methods, Frank H. Quinby, Chairman of the Brooklyn Chapter Subcommittee (and recently elected President of the New York State Association), under date of March 30, 1917, says:

ARCHITECT'S OR ENGINEER'S FEE CLAUSE.

"It is understood and agreed that this insurance also covers assured's liability for necessary fees for architects and engineers employed by them as a result of loss to the property insured, but in no case shall the loss and said fees combined exceed the amount of this policy, nor shall said fees exceed 6 per cent of the amount of the loss in case of a total loss, nor shall said fees exceed 10 per cent of the amount of the loss in case of a partial loss."

To attach to and form part of Policy No. . . . of the
. . . . Insurance Company of
Date. Agent.

3. See, also, pamphlet "General Information Regarding Fire Insurance Requirements," referred to under 4B2e1; also distributed by N.F.P.A., see 3A3d14.
4. See "Prevention Measures in Buildings versus Fire Insurance," F. S. Baker. "Proceedings" N.F.P.A., Vol. 14, p. 141.
5. See "Self Inspection by the Assured," "Proceedings" N.F.P.A., Vol. 4, p. 206.

(Not previously referred to)

"The Legislation Committee of the New York State Association, A.I.A. has prepared a bill providing for a State Commission to investigate and report on the necessity or desirability of a state building code.

This measure has been approved by the four chapters in the state and the builders and fire underwriters and is now pending in the legislature.

I am enclosing copy of the bill" (which follows).

AN ACT to provide for the appointment of a commission to investigate and report on the necessity or desirability for the enactment of a state building code, and making an appropriation therefor.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. *Appointment of Commission: Term; Qualifications.* A commission to investigate and report on the desirability and necessity of the enactment of a state building code is hereby created. Such commission shall consist of seven members, to be appointed by the Governor, one of whom shall be an employing carpenter contractor, and an employing mason contractor, both of whom shall be actively engaged in building operations; two architects, one structural engineer, one expert in fire-prevention and one attorney. Each of such persons so appointed shall have been actively engaged in his respective calling or profession for at least ten years. The term of each commissioner shall be two years from the date of his appointment, unless further extended by the Legislature on the recommendation of the Governor, and each commissioner shall receive such pay in addition to his actual traveling and other expenses as is consistent and within the appropriation made by the Legislature to cover the total expense of the commission. Before making such appointments, the Governor shall invite recommendations from architects' and builders' and engineers' organizations and from the board of Fire Underwriters as to those best qualified to serve on such commission. The commissioner of public works and the chairman of the committees on buildings of the Senate and Assembly, if such committees are appointed, shall be ex-officio members of such commission. The Governor shall have the power to fill all vacancies in the commission but shall maintain each class of commissioners as herein described.

2. *Power of the Commission.* Such commission shall elect a chairman and an executive secretary. The executive secretary may not be, however, a member of such commission, and in the event that he is not a member of such commission, he shall have no vote in the deliberations of the commission. Such commission shall fix the salary of the executive secretary and may appoint, and at any time may remove, such other assistants as it shall deem necessary and fix their compensation.

3. *Duties of the Commission.* The commission shall investigate and report on the desirability or necessity of the enactment of a state building code. If it finds that such a code is desirable, the commission shall prepare and report to the Legislature a draft thereof giving the requirements essential to govern the safe construction of all buildings erected in the state, the maximum working stresses to be imposed on materials to be used and the qualities of the same, and the minimum requirements as

to safety from danger of fire or collapse in all classes of buildings, and the means whereby such code shall be enforced by existing local machinery provided or to be provided therefor. Nothing contained in such proposed code shall reduce the requirements of any existing state law with regard to protection of health or property in factories, mercantile establishments or tenement houses nor infringe the right of any municipal corporation to enact and enforce its own building or other ordinances, nor reduce the requirements of any such code, provided the requirements of such ordinances or codes are equal to or greater than those of the state code. Such reports shall be made by the commission not later than the fifteenth day of January, nineteen hundred and eighteen, un-

less the time therefor is extended by the Legislature on the recommendation of the Governor.

4. The sum of twenty thousand dollars (\$20,000), or so much thereof as may be necessary, is hereby appropriated out of any moneys in the treasury not otherwise appropriated, to be paid by the State treasurer on the warrant of the comptroller on the audit of the chairman of the commission, ten thousand dollars of which sum shall be immediately available and the other ten thousand dollars to be available on the first day of January, nineteen hundred and eighteen.

5. This act shall take effect immediately.

4K Structural Matters in General

1. *Conventions and Meetings.*

Attention is directed to the Twenty-first Annual Convention of the National Fire Protection Association which will be held in Washington, D. C., on May 8-10, 1917. Two days' sessions will be held in the New Willard Hotel, and one day's session at the Bureau of Standards. Members of the Institute's Committee on Fire-Prevention will be delegates, and members of the Committee on Materials and Methods will attend. A cordial invitation is extended by the association to all members of the Institute to be present.

2. *Standard Specification for Magnesia Pipe Covering.*

The Editor is pleased to direct attention to every activity or advance in connection with the standardization of structural materials or processes.

The following letter to the Editor has been received from the Chairman of the Institute's Committee on Materials and Methods:

March 12, 1917.

I have before me the "Specification for '85% Magnesia' Non-Conducting Coverings for Power and Heating Systems." This specification is issued by the Magnesia Association of America and represents the best established practice based on over a quarter of a century of experience.

The engineering experience upon which this Specification is formulated covers all users of "85% Magnesia" insulating, including the U. S. Navy (where "85% Magnesia" has long been the regulation covering), power-plants, factories, and heating systems for buildings of all sizes.

I would suggest, as Chairman of the Institute Committee on Materials and Methods, that the attention of the profession be called to this standard specification which may be obtained in two forms, one a very brief form and another full and detailed and ready for incorporation in any specification. It is so written that any part not applicable to any particular work may be omitted.

This standard specification is so well arranged and of such assistance to architects that I think the Association referred to is to be complimented upon its production and publication.

(Signed) THOMAS NOLAN

Chairman Committee on Materials and Methods.

3. *Gypsum Report Issued.*

The Geological Survey, U. S. Department of the Interior, now has available for distribution its annual statement on Gypsum for 1915, which states the quantity of crude gypsum mined in the United States during the year to be 2,447,611 short tons.

4. The *Publicity Bureau* of the *Associated Metal Lath Manufacturers*, in a recent announcement regarding the removal of their offices from Chicago to Cleveland, and the appointment of Mr. Zenas W. Carter as Commissioner, states that among the plans of the Metal Lath Association is one for a coöperative national campaign of publicity which will be developed by the Council of Advertising Managers of the member companies.

Their plans cover a series of extensive and exhaustive tests of the fire-resistance properties of metal lath, its use in fire-retarding construction, the exploitation to architects and the public of the saving in space which can be effected through the use of this material, its vermin- and rodent-proofness, investigation and assistance in the revision of building codes of cities so that metal lath may receive its proper recognition by city officials and engineers.

Mr. Carter was the first General Secretary of the Electric Development Association when it was incorporated in New England. The Julian Armstrong Bureau of Related Industries will continue its special work for the Associated Metal Lath Manufacturers.

Gypsum.

A committee of the American Society for Testing Materials is endeavoring to write specifications for gypsum and gypsum products, which are largely used as wall plasters and fire-proof partition tile. Among other things, the committee desires to develop standard methods for testing the material. This bureau has coöperated by carrying out some of the necessary laboratory experiments to determine whether any one of the methods now in use is better than any other and to devise new methods when needed. The tests at present being investigated are chemical analysis, microscopic examination, normal consistency, water-carrying capacity, time of set, tensile strength, and sand-carrying capacity. (From Report of the Bureau of Standards, 1916.)

Serial No. 5

WOOD ISSUE

TIMBER, LUMBER, WOOD CONSTRUCTION AND FINISH

CONTENTS

As indicated by the title and explained in the March number, this issue will be devoted to all forms and uses of wood in building construction. At the same time it completes the exterior shell and covers it, of the composite building with which this Department is concerned and provides for much of the interior finish—fittings, furniture and movable features will be treated later.

The Index below, together with the explanatory notes under many of the separate headings, will sufficiently

explain the sequence whereby wood is considered, first as standing timber and taken up by progressive stages from its management and utilization under Governmental direction through its manufacture, treatment, use and finish in building construction.

From now on several issues will deal with separate features of installation, such as, for instance, electricity, which will be referred to in June Serial No. 6.

MAY, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

- 5A1** U. S. Department of Agriculture, Forest Service, and Forest Products Laboratory.
- 5A2** Committee D-7, on Timber, American Society for Testing Materials.
- 5A3** Committee of American Railway Engineering Association.
- 5A4** Committee on Uses of Wood in Building Construction. N. F. P. A.
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- 5C** State Wood-Using Industry Reports.
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- 5M** Current Comment.

5A1 United States Department of Agriculture, Forest Service

Forester, Henry S. Graves, 928 F Street, Washington, D. C.
FOREST PRODUCTS LABORATORY, Madison, Wisconsin.

Publications:

- (a) Department of Agriculture Yearbook.
- (b) Annual Report of the Forester.
- (c) Professional Papers. Published as Bulletins of the Department of Agriculture.
- (d) Farmers' Bulletins.
- (e) Contributions to the *Journal of Agricultural Research*. For sale only by the Superintendent of Documents, Government Printing Office, Washington, D. C. To be found, also, in the libraries of agricultural colleges, universities, technical schools, and other institutions.

(f) Yearbook Separates.

(g) Miscellaneous publications.

Of the above (b), (c), (d) and (f) are in stock, to a limited number, and single copies of those available will be distributed free upon request to the Division of Publications, Department of Agriculture, Washington, D. C. The Yearbook can be obtained free only through Congressmen. Copies are also sold by the Superintendent of Documents.

(h) Much of the information obtained through the researches of the Service is published in various trade and technical journals. Lists of such articles, a great many of which are included under 5D1c, may be obtained by application to the Forest Service, Washington, D. C., or to the Director, Forest Products Laboratory, Madison, Wis. Frequently reprints are available in limited quantities for free distribution.

- (j) The Department of Agriculture issues a monthly list of publications which lists all new publications of the Department as they appear. This list is for free distribution upon application to the Division of Publications, Department of Agriculture, Washington, D. C. Lists of those publications of the Forest Service which are still in print, but are no longer for free distribution, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. (Price-list 43, which is kept up to date by periodical revision.) The various price-lists are the only documents distributed free of charge by the Superintendent of Documents.
- (k) In addition to the above series, there were formerly published a series of Forest Service bulletins and a series of Forest Service circulars, many of which are still in print. Copies of a few of these are still available for free distribution, and copies of many others can be obtained only through the Superintendent of Documents.
- (l) Many publications, containing information of value, now out of print, are not listed by the Superintendent of Documents and may be seen only in public or technical libraries. These are contained in a mimeographed list of all publications issued by the Forest Service which may be had upon application to the Forest Service.

The work of the Forest Service consists of the administration and protection of the National Forests, the development and utilization of their resources, and research into technical problems connected with forestry; also the discovery and dissemination of knowledge concerning the best uses of forest products. Forest products include wood pulp, turpentine and rosin, tannin, dyes, charcoal, acetate of lime, alcohol, and a considerable number of lesser chemical products. Lumber, however, is the most important of the forest products, and as a material of construction is the one of most concern to the architect.

An impression seems to be prevalent that the supply of timber is becoming depleted, but there is still enough of the virgin stand of several important species to last for several generations, and with the growing practice of forestry methods, a certain supply of lumber will always be available.

Wood has been, and still is, one of the chief materials used in construction. It has natural advantages because of the ease with which it can be worked and fastened, its light weight, its poor conduction of heat, and its pleasing appearance. These properties are due to its peculiar physical structure, which also makes it non-homogeneous and highly variable as compared with clay and metal products. In competition with these other materials, wood has suffered because of improper use which can be corrected only by a better knowledge of its properties. The Forest Service is contributing to this knowledge through its experimental investigations. Statistical studies covering the manufacturing of lumber, markets, and uses, are made by the Office of Industrial Investigations at Washington, D. C., and studies relating to the properties of wood, its protection against fire and decay, and its proper use in construction of all kinds are made at the Forest Products Laboratory, Madison, Wis.

Since the laboratory was opened in 1910, over 130,000 tests have been made on practically all commercial woods of the United States. These tests include bending, compression, shear tension, cleavage, and hardness, and establish the comparative strength values of the various species. They are also the basis on which has been established the relation between the physical and mechanical properties of wood, such as the relation of moisture, density, and rate of growth to strength. Special tests are made on methods of fastening and on finished products made of wood, such as barrels and boxes. A box-testing machine has been devised which approximates closely the conditions met in actual service and gives results easily interpreted.

It is the aim usually to employ the data from mechanical tests in the perfecting of grading rules and specifications. That has already been accomplished in a number of cases. For example, the grading rules for southern pine structural timber adopted by the American Society for Testing Materials, the American Railway Engineering Association, and the Southern Pine Association; assistance given the city of New York and other cities, the Wisconsin Industrial Commission and the National Board of Fire Underwriters in the preparation of building codes and specifications for timber; specifications for canned-goods boxes adopted by the National Canner's Association and the American Society for Testing Materials; specifications of the Interstate Commerce Commission for shipping containers.

The use of refractory woods and the increasing necessity for artificial seasoning have added new problems in the conditioning of wood. Improper drying methods will injure the strength of wood. It is also very necessary, for many purposes, that the wood should stay put and this depends to quite an extent on proper conditioning. Investigations at the laboratory have resulted in the design of a kiln in which it has been possible to overcome many of the difficulties met with in common practice. The kiln has been patented and dedicated to the public. Direct assistance has also been rendered in the design of commercial kilns wherever the Forest Service has been called upon to do so.

In order that wooden construction may be permanent, it should be protected from both fire and decay. Moisture is necessary for decay, but too little or too much moisture will prevent it. For instance, interior finish is protected under normal conditions, and wood kept immersed in water is not subject to decay, except that in the sea it is attacked by marine borers. There are also conditions under which wood will not be subject to destruction by fire, but the architect at some time meets the danger from both decay and fire and will recognize the importance of preventive measures.

Tests have been made on more than thirty wood preservatives, including creosotes and various salt solutions, to determine their ability to check the growth of fungus, their ability to penetrate wood, their effect on the strength of the wood, and their permanence. The preservative represents from 50 to 75 per cent of the cost of treatment. This is particularly true of the creosotes, necessitating their careful analysis and grading, and Forest Service investigations have aided materially in establishing standards in commercial practice.

There is a growing need for a preservative which, after injection into wood, can be painted over. Wood treated with creosote will not take paint, and wood treated with zinc chloride will not hold paint well, particularly when exposed to the weather. Sodium fluoride offers possibilities in this direction. It is very antiseptic, practically non-corrosive in contact with iron and steel, and strength tests show it has no apparent effect upon the mechanical properties of the wood. Several panels treated with sodium fluoride and zinc chloride, and then painted with white lead and zinc oxide paint, were exposed to the weather in different parts of the country, and after eighteen months there was no difference between those treated with the fluoride and the untreated paint, while the panels treated with zinc chloride had peeled.

The economy in the use of treated wood depends largely upon the comparative life of the natural and the treated material. As a basis for comparison, matched specimens are first tested on a small scale where conditions are readily controlled. Later, actual service tests are conducted in

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coöperation with the large users of wood—railroads, telephone and telegraph companies, and municipalities.

Our congested districts and high buildings increase the natural fire-hazard and demand fire-resistant materials. Fireproof construction at present means a minimum use of wood, unless wood can be made fire-resistant. Investigations have been made along two lines in developing a fire-retardant—impregnation and surface painting. A fire-test house has been built in which it is possible to approximate office-building conditions, and a number of demonstrations have been made. The Forest Service has in this way been able to assist the National Fire Protection Association in developing specifications for wood in fire-resistant construction. A patent has been granted, and dedicated to the public, covering a method of treating wood and fibrous materials to make them fire-resistant.

It is the policy of the Forest Service to undertake any investigative work pertaining to the use of forest products, provided the problem is of general interest, and it seeks at all times to secure the coöperation of the various associations affected.

5A2 Committee D-7 On Timber, American Society for Testing Materials, (1A2), (Formerly Committee 2)

Chairman: Herman von Schrenk, St. Louis, Mo.

This Committee was organized in 1904 for the purpose of developing standards dealing with timber in its various forms, both as to treated and untreated timber, and for developing standard methods for inspection of timbers, both treated and untreated, and processes used in connection with the preservation of timber.

The early work of this Committee was devoted to the adoption of standard names for various kinds of wood and accurate definitions for various types of defects. These standard names and standard definitions for defects now form part of the Book of Standards of the Society. The Committee has also devoted considerable time to specifications for bridge and trestle timbers, and in 1910 adopted standard specifications for such timbers, which were revised in 1915.

The most important recent work of the Committee has consisted in formulating a new rule for southern yellow pine timbers (popularly known as the "Density Rule," and referred to under 5D3 and 5D4). The standard adopted in 1915 was the result of continuous work on the part of the Committee since 1904. Realizing the difficulty in the botanical classification of longleaf, shortleaf and loblolly pine, the Committee endeavored to formulate a definition which would make possible the proper identification of timbers of high strength value by the ordinary man. In coöperation with the United States Forest Service, this new definition was formulated. After its adoption it was accepted by the manufacturers of southern yellow pine as their standard, and has since been adopted by the American Railway Engineering Association, as well as numerous railroad companies and other users of structural yellow pine timber.

The Committee at the present time is engaged in formulating a similar standard for structural Douglas fir timber.

Committee D-7 has furthermore formulated standards for the distillation and fractionation of creosote oil, and in its report this year is presenting a tentative standard for wood-block paving.

In addition to the foregoing, various subcommittees are investigating such questions as making wood fire-resistive, the relation between the qualities of timbers and their ultimate use, standard methods for inspection of timbers, etc., the subcommittees bearing the following titles: I, On Classification and Designation of Southern Yellow Pines; II, On Uses of Untreated Yellow Pines; III, On Pacific Coast Timbers; IV, On Wooden Paving Blocks; V, On Methods of Preservative Treatment of Timber; VI, On Timber Preservatives; VII, On Inspection of Treated Timber; VIII, On Fireproofing of Timber.

5A3 Committee on Grading of Lumber, American Railway Engineering Association (1A9)

Chairman: Herman von Schrenk, St. Louis, Mo.

This Committee was organized in 1911. It has devoted most of its work to the adoption of standard names for timber, and particularly to the study and arrangement of the classification and grading rules of various classes of lumber. Up to the present time the A. R. E. A. has

adopted standard grading rules for lumber as follows: Southern yellow pine, Douglas fir, construction oak timbers, cypress, and hemlock. Under each kind of lumber, definitions for defects are given. The rules were adopted after conferences with the grading rule committees of the various manufacturing associations in order to harmonize the manufacturers' rules as far as possible with those used by the consumer.

The principal work in which the Committee is engaged at the present time deals with the relation between lumber grades and the uses to which the various grades are to be put. The preliminary report on the general classification of uses was made at the annual convention in 1916, and the rules above referred to are published in the "Manual," as mentioned under 5D3b.

5A4 Committee on Uses of Wood in Building Construction, National Fire Protection Association

Chairman: Julius Franke, New York, N. Y.

This Committee has submitted reports to the last two conventions of the National Fire Protection Association.

The Report submitted to the 1915 Convention, printed in the published Proceedings and also separately as referred to under 5E1b, was an important contribution on "The Inflammability of Treated and Untreated Woods."

The Report to the 1916 Convention was a progress report on the work of this Committee concerning the subject of "Mill-constructed Buildings."

The Report to the 1917 Convention will contain a new Standard for Mill-construction to supersede the existing one, which, although excellent in ways, has gradually become out of date and it has become necessary to revise it. The new features will deal mostly with the question of the decay of wood and how to avoid it, and also with the strength of timber and how to calculate the same. After action by the Convention in Washington, May 8 to 10, 1917, the Report will appear in the Proceedings of the Twenty-first Annual Meeting.

5A5 Committee on Lumber and Timber Specifications, Illinois Society of Architects

Chairman: Robert S. Linstrom, Chicago, Ill.

No report being available, a portion of the account given in *The American Contractor*, January 29, 1916, of the formation of this Committee is quoted as of interest.

The specification of lumber is one of the important functions of the architect. It was the paramount topic for discussion and action at the regular monthly meeting of the Illinois Society of Architects held last Tuesday evening at the Art Institute, Chicago. The meeting was attended by the largest number of architects in the history of the organization, and the program was a most interesting and important one.

The principal speakers of the evening were W. J. Haynen, of Hattiesburg, Miss., chairman of the Grading Rules Committee of the Southern Pine Association; A. T. North, consulting engineer, Chicago; and Dr. von Schrenk, St. Louis, consulting engineer of the Southern Pine Association. A large number of Chicago lumber dealers were present.

After an extended discussion, the Southern Yellow Pine Association and the Chicago Lumber Association volunteered to coöperate with the Illinois Society of Architects in formulating standard architectural specifications for all classes of timber and lumber. The committee to take up that work for the Illinois Society of Architects was appointed. (Mr. F. D. Chase, who was made chairman, has been succeeded by Mr. Linstrom.)

5A6 Educational, Research Work and Other Agencies

The U. S. Forest Service furnishes lists of colleges and schools with (a) ranger courses in forestry, (b) courses in forestry other than ranger, (c) courses leading to a degree in forestry; of these some provide facilities for investigation, research and testing, as mentioned under 1B3a, and others, as in the case of (d) the University of Illinois, maintain engineering experiment stations and issue bulletins and circulars (3C2a), and one (e), the University of Wisconsin at Madison, maintains close coöperative relations with the Forest Products Laboratory. At this University, in addition to the courses (b), a number of special lectures are given in various departments by members of the Forest Products Laboratory staff, and opportunities are also offered in these Laboratories for research work. One (f), the New York State College of Forestry, maintains a Wood Utilization Service, with Henry H. Tryon in charge. (See, also, 5C16.)

When the New York State College of Forestry was started at Syra-

cuse in 1911, one of the first problems that confronted the institution in its state-wide educational campaign was that of decreasing the amount of unnecessary waste which goes on in the lumber and woodworking industries. To accomplish this, what is now known as the Wood Utilization Service was instituted, and shortly thereafter the Department of Forest Utilization was formed and was given full charge of this Service.

Professor Tryon is desirous of bringing to the attention of all members of the Institute the Correspondence Course in "Lumber and Its Uses" which is a part of the Wood Utilization Service.

One-page bulletins are published intermittently. Each bulletin contains a number of items, usually ten. The information used in the building up of these bulletins has always been obtained through voluntary correspondence addressed to the college, and architects are invited to correspond with the Department in the interest of conservation and a better understanding of lumber and its uses.

5B1 The National Lumber Manufacturers Association

Secretary: R. S. Kellogg, 11 South LaSalle Street, Chicago, Ill.

Publications:

Issues a series of bulletins upon structural timber, mill-construction buildings, and upon rural architecture; also technical letters especially adapted to the files of architects and engineers upon subjects such as building-code suggestions, creosoted wood-block paving, pier and wharf and other forms of construction. Through these publications and through its Engineering Bureau later referred to, the Association seeks to give the best and most helpful advice upon all species of wood in order to secure most appropriate use, the longest service, and the greatest satisfaction to all concerned.

These are published in series as follows, the various titles being referred to under the appropriate later sub-divisions in this department of the Journal. Any of these, with the exception of (f), will be furnished without charge to qualified inquirers.

- (a) Rural Architecture. Valuable suggestive bulletins, the ten of which are described under 5G2c5.
- (b) Engineering Bulletins. The two published to date are described under 5G1a1 and under 5G2c4.
- (c) Better buildings. Two publications to date.
- (d) Technical letters. Nine in all.
- (e) Miscellaneous publications. Three to date.
- (f) Arrangements have recently been made with the publisher, the Radford Architectural Company, Chicago, for a special handbook edition of the 400-page volume entitled "Lumber and Its Uses" which on behalf of the National Lumber Manufacturers Association, will be supplied by the publisher at \$2 per copy. (Revised Edition now on the press.) This volume deals in a broad way with the properties and commercial uses of all the principal American woods, and its contents will be found referred to under the appropriate sub-divisions in this issue of the Journal.

The National Lumber Manufacturers Association is a federation of the principal associations of lumber manufacturers throughout the United States, whose purposes, as set forth in its charter are to

"Gather and disseminate information upon the production and shipments of lumber, market conditions, and the supply of forest products; to make technical and other investigations of the properties and uses of woods; to promote uniformity and efficiency in the methods of manufacturing and distributing lumber and allied products . . . and to promote the use of forest products by all lawful means."

The organizations affiliated with the National Lumber Manufacturers Association, and the kinds of timber chiefly handled by them are indicated in the list given under 5B1a.

Each of these associations has standard rules for the grading and inspection of the lumber manufactured by its members, which, together with much helpful literature about their products, may be had upon request. Two other organizations which work in harmony with the National Lumber Manufacturers Association upon problems of national interest are the Gum Lumber Manufacturers' Association, Memphis, Tenn., and the American Oak Manufacturers' Association, Memphis, Tenn.

The National Lumber Manufacturers Association maintains an engineering bureau, the services of which are freely available for advice and suggestions as to the use of wood for all structural purposes.

This has been established as a clearing house of authoritative information relative to the most advantageous use of woods for all of its numerous great adaptabilities. The purpose is to encourage the use of wood where wood is best to be used and to avert the misuse of wood through the public lack of knowledge of the special merits of the several distinct species.

It aims to coöperate with architects, engineers, builders, and others by furnishing upon the basis of the best engineering and architectural practice in wood construction all latest available data, and assisting them and the lumber-consuming public in receiving the greatest economic

benefit from the proper application of wood, without desiring to urge that wood be used except where best for the purpose intended.

5B1a Other Lumber and Allied Associations

Among such there are (not including those interested in other than structural products) the following, those marked (*) being affiliated with the National Lumber Manufacturers Association (5B1), immediately after the name of which follows the kinds of lumber chiefly handled by them:

- 1.*West Coast Lumbermen's Association, Seattle, Wash.
Douglas Fir, Western Red Cedar, Spruce, Hemlock.
- 2.*Georgia-Florida Sawmill Association, Jacksonville, Fla.
Yellow Pine.
- 3.*Hardwood Manufacturers' Association of the United States, Cincinnati, Ohio.
Ash, Basswood, Beech, Buckeye, Butternut, Cherry, Chestnut, Cottonwood, Elm, Gum, Hickory, Maple, Oak, Walnut, Poplar, Sycamore, Tupelo.
- 4.*Michigan Hardwood Manufacturers' Association, Cadillac, Mich.
Ash, Basswood, Beech, Birch, Elm, Maple, Hemlock.
- 5.*Northern Hemlock and Hardwood Manufacturers' Association, Oshkosh, Wis.
Hemlock, Ash, Basswood, Birch, Elm, Maple, White Cedar, Tamarack.
- 6.*California Redwood Association, San Francisco, Cal.
Redwood.
- 7.*Southern Cypress Manufacturers' Association, New Orleans, La.
Cypress, Tupelo.
- 8.*California White and Sugar Pine Association, San Francisco, Cal.
Sugar Pine, California White Pine.
- 9.*North Carolina Pine Manufacturers' Association, Norfolk, Va.
North Carolina Pine.
- 10.*Northern Pine Manufacturers' Association, Minneapolis, Minn.
White Pine, Norway Pine, Spruce, Tamarack.
- 11.*Southern Pine Association, New Orleans, La.
Southern Pine.
- 12.*Western Pine Manufacturers' Association, Spokane, Wash.
Western Pine, Idaho White Pine, Fir, Larch.
13. Arkansas Soft Pine Bureau, Little Rock, Ark.
14. White Pine Bureau, St. Paul, Minn.
15. Gum Lumber Manufacturers' Association, Memphis, Tenn.
16. National Hardwood Lumber Association, Chicago, Ill.
17. American Oak Manufacturers' Association, Memphis, Tenn.
18. Carolina Air-Dried Pine Association, Raleigh, N. C.
19. East Oregon Lumber Producers' Association, LaGrande, Ore.
20. Eastern Lumberman's Association, Bangor, Me.
21. Eucalyptus Hardwood Association, Los Angeles, Cal.
22. Hardwood Dimension Manufacturers' Association, Arlington, Ky.
23. Hemlock Manufacturers' Promotion Bureau, Oshkosh, Wis.
24. Humboldt Lumber Manufacturers' Association, Eureka, Cal.
25. Indiana Hardwood Lumbermen's Association, Indianapolis, Ind.
26. Lumber Manufacturers' Association of Southern New England, Ansonia, Conn.
27. Mississippi Pine Association, Hattiesburgh, Miss.
28. Mountain Lumber Manufacturers' Association, Nelson, B. C.
29. Northern White Cedar Shingle Association, Oshkosh, Wis.
30. Tennessee Manufacturers' Association, Nashville, Tenn.
31. West Alabama Pine Association, Tuscaloosa, Ala.

5B1b Other Associations Specifically Concerned with Wood Problems and Products

Among such are the following, exclusive again of those with interests outside of building construction, and not including also those interested in furniture manufacture:

1. American Wood-Preservers' Association, Baltimore, Md.
2. Association of Creosoting Companies of the Pacific Coast, Seattle, Wash.
3. Creosoted Wood Block Paving Bureau, Chicago, Ill.
4. Northern White Cedar Shingle Manufacturers' Association, Oshkosh, Wis.
5. Redwood Shingle Association, Eureka, Cal.
6. Shingle Branch, West Coast Lumbermen's Association, Seattle, Wash.
7. Maple Flooring, Manufacturers' Association, Chicago, Ill.
8. Oak Flooring Manufacturers' Association, Cincinnati, Ohio.
9. Eastern Sash, Door, and Blind Manufacturers' Association, Holmesburgh, Philadelphia, Pa.
10. Millwork Cost Information Bureau, Chicago, Ill.
11. Southern Sash, Door, and Millwork Manufacturers' Association, Atlanta, Ga.
12. Curtis Service Bureau, Clinton, Iowa.
13. Building Industries Association, St. Louis, Mo.

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14. National Veneer and Panel Manufacturers' Association, Indianapolis, Ind.
15. Commercial Rotary Gum Association, Memphis, Tenn.

In addition to which, representing artisans and others engaged in some of the wood industries, there exists:

16. Brotherhood of Carpenters and Joiners, Indianapolis, Ind.
17. Wood Carvers' and Modellers' Association, Philadelphia, Pa.
18. International Wood Carvers' Association of North America,

5C State Wood-Using Industry Reports

Prepared by the United States Department of Agriculture, Forest Service, Office of Industrial Investigations.

The Forest Service has completed studies of wood-using industries in a number of states. The reports, primarily of local interest, containing information which should be of much value to architects and builders, have been printed by some department of the Government of the state interested, or by a periodical devoted to the interest of lumbering and conservation. Bulletins at present available are indicated below and may be secured from the coöperator whose address is given. In ordering those for which there is no charge, postage should accompany the application. (See also §A6.)

State	Coöperator	Address	Price
1. Ala.	Lumber Trade Journal	New Orleans, La.	\$0 25
2. Ark.	Supt. of Doc., Gov. Print. Ofc.	Washington, D. C.	05
3. Ark.	Separate Directory of Wood-Using Plants, Lumber Trade Journal	New Orleans, La.	....
4. Cal.	G. M. Homans, State Forester	Sacramento	....
5. Conn.	W. O. Filley, State Forester	New Haven	....
6. Fla.	W. A. McRae, Comr. of Agr.	Tallahassee	....
7. Ga.	Lumber Trade Journal	New Orleans, La.	....
8. Ill.	J. C. Blair, Univ. of Ill.	Urbana	....
9. Ind.	Forest Service	Washington, D. C.	....
10. Me.	State Forest Commissioner	Augusta	....
11. Mich.	Public Domain Commission	Lansing	....

State	Coöperator	Address	Price
12. Miss.	Lumber Trade Journal	New Orleans, La.	\$0 25
13. Mo.	St. Louis Lumberman	St. Louis	10
14. N. H.	E. A. Hirst, State Forester	Concord	25
15. N. J.	Alfred Gaskill, State Forester	Trenton	....
16. N. Y.	State College of Forestry	Syracuse	....
17. N. C.	J. S. Holmes, State Forester	Chapel Hill	....
18. Ohio	Edmund Secrest, State Forester	Wooster	....
19. Pa.	R. S. Conklin, Commissioner of Forestry	Harrisburg	....
20. S. C.	E. J. Watson, Commissioner of Agriculture	Columbia	....
21. Tenn.	Southern Lumberman	Nashville	....
22. Tex.	Lumber Trade Journal	New Orleans, La.	25
23. Vt.	A. F. Hawes, State Forester	Burlington	....
24. Va.	G. W. Koerner, Commissioner of Agriculture	Richmond	....
25. W. Va.	H. E. Williams, Comr. of Agr.	Charleston	....
26. Wis.	F. B. Moody, State Forester	Madison	....

The supplies of the wood-using reports in the following states are entirely exhausted: 27. Idaho, 28. Iowa, 29. Kentucky, 30. Louisiana, 31. Maryland, 32. Massachusetts, 33. Minnesota, 34. Montana, 35. Oregon, and 36. Washington.

5D Standing Timber and Manufactured Lumber: Localities, Kinds and Classifications

Closely allied to this subdivision is that on Wood in Buildings and in Structures in General, where the publications pertaining to specific uses in buildings are separated as well as possible from those here described, which deal more with the product, its source, and general uses.

5D1 Publications and Articles. Listed by the U. S. Department of Agriculture, Forest Service, Washington, D. C., and Forest Products Laboratory, Madison, Wis.

(a) The U. S. Department of Agriculture, Forest Service, §A1, issues a large number of publications pertaining to the silvicultural end of the work—that is the planting, growing and management of trees in forests—and other publications relating to the supply and uses of woods in specified areas. Consult list of publications to be had, as mentioned under §A14.

(b) Other Governmental publications pertaining to this subdivision and of interest structurally which follow, under this (b) classification, can be obtained only from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price stated, until the supply is exhausted. Remittances should be made by money order or in coin (at sender's risk). Stamps can not be accepted. Those indicated by * are exhausted. For those not now obtainable through the Superintendent of Documents, see §A1j.

1. Wood-using industries and national forests of Arkansas: Part 1, Uses and supply of wood in Arkansas; Part 2, Timber resources of national forests in Arkansas. 1912. 40 pp. (Forest Bulletin No. 106.) 5 cents.
2. Uses for chestnut timber killed by bark disease. 1914. 24 pp., illus. (Farmers' Bulletin No. 582.) 5 cents.
3. Properties and uses of Douglas fir: Part 1, Mechanical properties; Part 2, Commercial uses. 1911. 75 pp., illus., map. (Forest Bulletin No. 88.) 15 cents.
4. Southern Cypress. 1915. 74 pp., illus. (Agriculture Bulletin No. 272) 20 cents. Embraces geographical and commercial range, present supply and annual cut, properties and use of wood, markets and prices, life history of the tree, etc.

5. Red gum, with discussion of mechanical properties of red gum wood. Revised 1906. 56 pp., illus. (Forest Bulletin No. 58.) 15 cts. Sweet gum or star-leaved gum of the southern states.
6. Eastern hemlock, *Tsuga canadensis*, Linn., Carr. 1915. 43 pp., illus. (Agriculture Bulletin No. 152.) 10 cents. Describes characteristics, gives tables of its volume and rate of growth, and chief facts regarding its utilization for lumber, pulp, tanning, etc.
7. Mechanical properties of western hemlock. 1913. 45 pp., illus. (Forest Bulletin No. 115.) 15 cents. Also known as hemlock spruce, western hemlock fir, Prince Albert fir, gray fir, and Alaska pine.
8. Larch: Mechanical properties of western larch. 1913. 45 pp., illus. (Forest Bulletin No. 122.) 10 cents.
9. Lumber saved by using odd lengths. 1910. 5 pp. (Forest Circular No. 180.) 5 cents.
10. Our timber supply (general information). 1914. 8 pp. 5 cents.
11. Seasoning of timber. 1903. 48 pp., illus. (Forest Bulletin No. 41.) 25 cents.
12. Strength values for structural timbers. 1912. 8 pp. (Forest Circular No. 189.) 5 cents.
13. Tests of structural timbers. 1912. 123 pp., illus., maps. (Forest Bulletin No. 108.) 20 cents. Tests of Southern yellow pines, Douglas fir, western hemlock, western larch, redwood, Norway pine, tamarack, red spruce, and white spruce.
14. Principles of drying lumber at atmospheric pressure, and humidity diagram. 1912. 19 pp., illus. (Forest Bulletin No. 104.) 5 cents.
15. Timber, elementary discussion of characteristics and properties of wood; with key to more important woods of North America. 1895. 88 pp., illus. (Forest Bulletin, No. 10.) 10 cents.
16. Forest trees of Pacific Slope. 1908. 441 pp., 207 illus. 60 cents. The illustrations show the foliage and fruit of the 150 species described.
17. Mahogany: Colombian mahogany, *Cariniana pyriformis*, its characteristics and its use as substitute for true mahogany, *Swietenia Mahogani*; with description of botanical characters of *Cariniana pyriformis*. 1911. 16 pp., illus. (Forest Circular No. 185.) 5 cents.
18. Hardwoods of Americas—Mahogany. (American Republics Bulletin, August, 1909, pp. 386 to 402, illus.) 25 cents.
19. Identification of important North American oak woods based on study of anatomy of secondary wood. 1911. 56 pp., 48 illus. (Forest Bulletin No. 102.) 10 cents. The illustrations furnish a means of identifying commercial woods.

20. Shortleaf pine, its economic importance and forest management. 1915. 67 pp., illus. (Agriculture Bulletin No. 308.) Paper, 15 cents.
 21. Sugar Pine. 1916. 40 pp., illus., map. (Agriculture Bulletin No. 426.) 15 cents.
 22. Physical properties of yellow pine. (Forest Circular No. 12.)
 - *23. Rules and Specifications for the Grading of Lumber, Adopted by the various Lumber Manufacturers of the United States, compiled by E. R. Hodson. 1906. 127 pp. (Forest Bulletin No. 71.) 15 cents.
 24. Economic aspects of the lumber industry. (Agriculture Report No. 114), extracts printed in *The American Contractor*, April 14, 1917.
 25. White pine under forest management. 1914. 70 pages, illus. (Agriculture Bulletin No. 13.) 15 cents. "Of all the trees of eastern North America white pine best combines the qualities of utility, rapid growth, heavy yield, and ease of management."
 26. Windbreaks, their influence and value. 1911. 100 pp., illus. (Forest Bulletin No. 86.) 30 cents. Deals with the best species of trees for planting as an obstacle to the surface winds and for the protection of orchards and field crops in various regions of the United States.
 27. Adhesion of nails, spikes, and screws in various woods. (In Tests of Metals, Watertown Arsenal 1B1b, 1884, pp. 448 to 471, illus.) Cloth, 60 cents. White pine, chestnut, yellow pine, white oak, and laurel were tested.
 28. Effect of moisture upon strength and stiffness of wood. 1906. 144 pp., illus. (Forest Bulletin No. 70.) 15 cents.
 29. Uses of commercial woods of United States: Beech, birches, and maples. 1913. 56 pp. (Agriculture Bulletin No. 12.) 10 cents.
 30. Uses of commercial woods of United States: (1) Cedars, cypresses, and sequoias, 1911. 62 pp. (Forest Bulletin No. 95.) 10 cents; (2) Pines. 1911. 96 pp. (Forest Bulletin No. 99.) 15 cents.
 31. Uses of wood. Pp. 391 to 420, illus. (In Agriculture Year-book, 1896.) Price of entire vol., cloth, 50 cents.
 32. Mechanical properties of woods grown in United States, preliminary summary of tests on small, clear, green specimens of forty-nine species of wood. 1913. 4 pp., 1 table. (Forest Circular No. 213.) 5 cents.
 33. The Strength of Wood as Influenced by Moisture, Harry Donald Tiemann. August 26, 1907. (Forest Circular No. 108.)
 - *34. Redwood, Mechanical properties of. Nov. 1, 1912. (Forest Circular No. 193.)
 - *35. Density of wood substance and porosity of wood. Sept. 21, 1914. (Published in *Journal of Agricultural Research*.) 25 cents.
 - *36. Southern pines, Properties and uses of. 1909. (Forest Circular No. 164.) 5 cents.
 - *37. Redwood, Mechanical properties of. 1912. (Forest Circular No. 193.) 5 cents.
- (c) Those which follow, under the (c) classification, are papers prepared by Forest Products Laboratory and published in proceedings of societies and technical, trade and other journals. The star before the name of an article indicates that no reprints are available for distribution. Such articles must be consulted in the original publication. Of the others a limited supply of reprints are available for general distribution, and copies will be sent free, until the supply is exhausted, upon application to Director, Forest Products Laboratory, Madison, Wis.
1. A Few Deductions from Strength Tests of American Woods, J. A. Newlin. *American Lumberman*, Jan. 16, 1915.
 2. Factors Affecting Structural Timbers, H. S. Betts. *Engineering Record*, Aug. 29, 1914.
 3. Grading Rules of Yellow Pine Structural Timber Discussed, H. S. Betts. *American Lumberman*, Apr. 24, 1915.
 4. Applicability of Yellow Pine Grading Rules to Other Timbers, J. A. Newlin. *Engineering Record*, Oct. 3, 1914.
 5. Air Seasoning of Timber, W. H. Kempfer. *American Railway Engineering Bulletin* No. 161; also *Railway Review*, Jan. 10, 1914.
 6. Effect of Different Methods of Drying on Strength of Wood, H. D. Tiemann. *Lumber World Review*, April 10, 1915.
 - *7. Fourth Progress Report on Tests of Treated Ties. American Railway Engineering and Maintenance of Way Association Bulletin No. 124.
 8. The Protection of Ties from Mechanical Destruction, H. F. Weiss, Proceedings American Wood Preservers' Association, 1914.
 9. Structural Timber in the United States, H. S. Betts and W. B. Greeley. International Engineering Congress, San Francisco, Sept. 20-25, 1915.
 - *10. Discussion of Proposed Forest Service Rules for Grading Strength of Southern Pine Structural Timber, H. S. Betts. American Society for Testing Materials, 1915.
 - *11. Effect of Moisture and Other Extrinsic Factors on the Strength of Wood, H. D. Tiemann. Society American Foresters, Proceedings, 1907.
 - *12. The Effect of Speed of Testing upon the Strength of Wood and the Standardization of Tests for Speed, H. D. Tiemann. American Society for Testing Materials, Proceedings, 1908, Vol. VIII.
 13. Eucalyptus Lumber: Part 1, To What Extent is California-grown Eucalyptus Suitable for Lumber? Part 2, Results of Experiments in Drying Blue Gum and other Species, H. D. Tiemann. *Hardwood Record*, Sept. 25, 1913.
 - *14. Kiln-Drying Lumber and a Discussion of the Whole Problem—A New Kiln, H. D. Tiemann. *Lumber World Review*, March 10, 1914.
 15. Principles of Kiln-Drying Lumber, H. D. Tiemann. *Lumber World Review*, Jan. 25, Feb. 10, 1915.
 16. Improvements in Forest Service Humidity Regulated Dry Kiln, H. D. Tiemann. *American Lumberman*, Sept. 1, Sept. 5, 1915; also *Hardwood Record*, Sept. 25, 1915.
- (d) The Government statistics of the lumber industry were formerly covered in publications, entitled "Forest Products," issued by the Department of Commerce, Bureau of the Census, compiled in coöperation with the Department of Agriculture, Forest Service.
- Annual statistics of the production of lumber, lath, shingles, and other forest products are now being obtained by the Forest Service and are being published as U. S. Department of Agriculture Bulletins, forming a part of this regular series. The latest lumber, lath, and shingle statistics will be found in U. S. Department of Agriculture Bulletin 506, entitled "The Production of Lumber, Lath, and Shingles in 1915 and Lumber in 1914." Copies of this may be obtained from the Division of Publications.

5D2 Government Specifications

(a) Specifications issued by the Navy Department for naval stores and materials.

The Navy Department issues specifications, as mentioned under 3A1a, those pertaining to wood being under Serial Designation No. 39, and covering among others the following kinds: Beech, Birch and Maple; Butternut; White Cedar; Douglas Fir; Puget Sound or Oregon Pine; Oak; White Oak Timber; White Pine; New England Country White Pine; Western White Pine (Idaho); Tonawanda White Pine, inspection rules for; Yellow Pine for decking, lumber, timber, and sticks for masts and spars; Spruce and Teak.

(b) Specifications of the War Department and Treasury Department (supervising architect's office).

The portions of such specifications with respect to lumber and wood-working are not separately issued as in the case of specifications for certain other branches of the work, as referred to under 3A1a, nor are they available for general distribution to others than those interested in the work for which prepared.

5D3 Specifications, Standards, Manuals and Publications of Technical, Professional and Other Organizations

- (a) American Society for Testing Materials:
 1. "Standard Definitions of Terms Relating to Structural Timber" (Serial Designation D 9-15), Book of Standards, 1916 (1A4c). Pp. 598-601.
(See Mr. von Schrenk's description under 5A2.)
- (b) American Railway Engineering Association:
 1. "Grading of Lumber." Adopted report of committee, completely illustrated with photographic reproductions of knots, streaks, holes and conditions, sound and otherwise. "Manual," 1915, (1A9f), pp. 591-653, containing:
 1. Classification and Grading Rules for Douglas Fir.
 2. Classification, Grading Rules and Dressing Rules for Southern Yellow Pine.
 3. Specifications for Construction Oak Timbers.
 4. Classification and Grading Rules for Cypress Lumber and Shingles.
- (c) National Board of Fire Underwriters:
 1. "Grading Rules for Timber," Building Code, 1915, pp. 278-283. These are printed as an appendix to the Code and comprise "a proposed revised form of Rules of the U. S. Forest Service for Grading Structural Timbers of Southern Yellow Pine;" also, tables for computing the strength of rectangular wooden beams and tables of allowable floor-loads for different kinds of woods.

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- (d) Inspection Department, Associated Factory Mutual Fire Insurance Companies:
 1. "Longleaf Pine Factory Timber" (3A7636.)
 2. "Dry Rot in Factory Timbers," 1915 (3A7445). 107 pp., illus. Contains specifications suggested for a special grade of longleaf pine for use in Mutual factories. Also a full discussion of varying conditions and precautions to be taken. Illustrates and describes timber available and discusses interstate rules for grading lumber and specifications of societies and associations and observations of the U. S. Forest Products Laboratory. (See, also, Chapter mentioned under 5E.)
- (e) Journal of Society of Constructors of Federal Buildings:
 1. "What Is a Plank?" Chas. E. Morrell, Jr. November, 1914. P. 385.
 2. "Inspection of Yellow Pine;" Hermann von Schrenk. March, 1916. Paper No. 205, p. 152.

5D4 Grading and Inspection Rules, and Other Publications of Lumber and Manufacturers' Associations

Other publications of other associations, bureaus and branches will be found mentioned under the various subdivisions to which they chiefly pertain.

- (a) National Lumber Manufacturers Association:
 1. "Timber for Structural Purposes," E. A. Sterling. Engineering Bulletin No. 1, January, 1916, 20 pp.
- (b) National Hardwood Lumber Association:
 1. See "Rules for the Measurement and Inspection of Hardwood Lumber." The purposes of these are to provide for the uniform inspection and measurement of the woods described therein.
- (c) Hardwood Manufacturers' Association of the U. S.:
 1. "Association Standard Grades of Poplar, Oak, Cottonwood, Gum and other Hardwoods." Effective October 1, 1915. 118 pp. Contains Classification, Official Grading, Inspection Rules and Sales Code.
- (d) Northern Hemlock and Hardwood Manufacturers' Association:
 1. "Rules for the Inspection of Hemlock Lumber," revised at Annual Meeting on January 29, 1913. 27 pp. Includes Standard Sizes adopted October 29, 1913.
- (e) Northern Pine Manufacturers' Association:
 1. "Rules for the Grading of Northern Pine, Spruce and Tamarack Lumber." Reported by the Bureau of Grades. Edition of February 1, 1915 (ninth issue). 72 pp.
- (f) The Oregon Lumber Manufacturers' Association (Since merged with the West Coast Lumber Manufacturers' Association):
 1. "Merits of Pacific Coast Woods," E. D. Kingsley. Being an address delivered before the Nebraska Lumber Dealers' Association at Omaha, on Feb. 6, 00. 16 pp.
- (g) Southern Pine Association:
 1. "Southern Yellow Pine Timbers, Including Definition of the 'Density Rule.'" Authorized reprint from the copyrighted Standards of the American Society for Testing Materials, approved and adopted by the Southern Pine Association, January 1, 1917. 22 pp.
 - (a) "Discussion of the Proposed Forest Service Rules for Grading the Strength of Southern Pine Structural Timbers," H. S. Betts. Appendix I, pp. 15-30. Contains diagrams and illustrations.
 - (b) "Southern Yellow Pine Timber and Density Grading Rules," O. T. Swan. Appendix II, pp. 31-47. Contains diagram and tables.
 2. "Standard Specifications for Grades of Southern Yellow Pine Lumber." April 1, 1917. 58 pp. (Supersedes all previous issues.) "Being the specifications for southern yellow pine lumber generally recognized by the lumber trade for years. Mills of manufacturers subscribing to this Association are located in the states of Texas, Arkansas, Missouri, Louisiana, Mississippi, Alabama, Georgia, and Florida." This contains specifications for all forms of a manufactured lumber, including dimension timbers, siding, fencing, ceiling, flooring, roofing and Byrkit lath, with full-sized detailed and figured drawings of all but the former.
 3. "The Gulf Coast Classification of Pitch Pine Resawn Lumber and Sawn Timber." Revised May, 1910, by the Gulf Coast Lumber Exporters' Association. Adopted by the Southern Pine Association 1915. 28 pp.
 4. "Service in the Department of Inspection and Grades." 1917. Describes in detail the functions of this Department, which include: Grading Rules, Grading Methods, Specifications and Standardization, Inspection at Point of Origin, Inspection at Point of Destination.
- (h) West Coast Lumbermen's Association:
 1. "The Lumber Users' Guide" (No. 8), a general description of Douglas fir.

- 2. "The Lumber Users' Guide" (No. 12), a general description of western red cedar. 22 pp., illus.
- 3. "Not the Non-Use but the Proper Use of Wood," a description of fire-test made by the Building Department of the city of Seattle in coöperation with the Port Commission, the City Fire Department and the West Coast Lumber Manufacturers' Association. 18 pp., illus.
- 4. "Comparative Strength Values for Structural Timbers." Leaflet giving tables.
- (j) California Redwood Association:
 1. "California Redwood Lives Forever." Leaflet. 8 pp., illus.
 2. "Two Births 2,000 Years Ago—The Marvel God Wrought with the Redwoods of California." Booklet. 12 pp., illus.
- (k) The North Carolina Pine Association, Inc.:
 1. "Official Inspection Rules," January 25, 1917, 24 pp., covering kiln-dried North Carolina Pine (revised 1917), Longleaf Pine (1905 Rules), Air-Dried North Carolina Pine (1913 Rules), Shortleaf Pine Dimensions (1910 Rules). It is stated that "at the present time fully 95 per cent of the output of pine lumber in the states of Maryland, Virginia, North and South Carolina is graded and classified according to these grading rules, and all quotations are made on them as a basis." In addition to rough and dressed lumber, describes, with full-sized drawings, all kinds of worked material including ceiling, partition, siding, shiplap and other forms.
- (l) Southern Cypress Manufacturers' Association:
 1. Issues a "Cypress Pocket Library" consisting of 41 Volumes, each of which describes different features and uses of this wood, some, as in No. 1, entitled "What It Is," describing generally the wood and uses (from Forest Service Bulletin No. 95, June 30, 1911), in which Volume is also an Index to all others.
- (m) American Oak Manufacturers' Association has in preparation a booklet on the growth and uses of oak which will shortly be ready for distribution.

5D5 Pocket-books, Textbooks and Publications by Educational Institutions and Publishers

- (a) Engineering Experiment Station, University of Illinois (3C2a2):
 1. "Tests of Timber Beams," Arthur M. Talbot. 1910. Bulletin No. 41. Free.
- (b) *American Forestry* publishes each month a list of titles, authors, and prices of books on forestry and related subjects. These may be ordered through the American Forestry Association, Washington, D. C.
- (c) "Lumber and Its Uses" (5B1f). Contains, among others, sections on: The Structure of Wood, Mechanical Properties of Wood, Lumber Grades, Standard Sizes of Lumber, Shipping Weights, Lumber Measurements, Lumber Manufacturing, Structural Timbers, Seasoning of Timber, Lumber Prices, The Uses of Lumber, Commercial Woods, Forest Products, Timber Supply, Permanent Advantages of Wood, and Sources of Information about Timbers.
- (d) "Building Construction and Superintendence," F. E. Kidder. 1915. Part II, "Carpenters' Work," contains, among others, sections on: The Tree, Physical Properties and Characteristics of Timber, Seasoning and Drying of Timber, Defects in Timber, Conversion of Timber, Strength of Timber as Affected by Its Physical Condition, Selection of Timber for Special Purposes, Decay and Preservation of Timber, Varieties of Timber Used in the United States—Their Characteristics and Uses, Data Relating to the Strength of Materials, and List of Tables.
- (e) "Mechanical Engineers' Handbook," Lionel S. Marks. 1916.
 1. "General Properties of Wood," H. von Schrenk. Pp. 577-585.
 2. "Strength of Wood," W. K. Hatt.
- (f) The Building Trades' Handbook:
 1. "Weights of Dry Woods," p. 68.
 2. "Description of Woods and Relative Hardness of American Woods," pp. 229-233.
 3. "Shrinkage of Woods," p. 234.
 4. "Qualities of Timber," pp. 234-236.
 5. "Quarter and Bastard Sawing," pp. 236-238.
- (g) See "Identification of the Economic Woods of the U. S.," Samuel J. Record.
- (h) "The Manufacture and Uses of Cypress." An illustrated address by Dr. Hermann von Schrenk before a meeting of Michigan lumbermen. Reprinted from the *Lumber Trade Journal*, New Orleans.
- (j) "Southern Cypress," Samuel J. Records. *American Architect*, October 18, 1916. Descriptive article, illus.
- (k) "The Strength of Long-Seasoned Douglas Fir and Redwood," Arthur C. Alvarez. May 17, 1913. Bulletin of the Department of Civil Engineering, University of California.
- (l) "One Thousand Uses for Oak," to be had from Oak Information Bureau of *Hardwood Record*, Chicago; gives names of all oaks, production, and uses.

- (m) "American Forest Trees," *Hardwood Record*. Practical information on commercial trees.
- (n) See "Principal Species of Wood—Their Characteristic Properties," Charles Henry Snow. 1908.
- (o) See "Timber and Timber Trees," Thos. Haslett and H. M. Ward. 1894.

5D6 Branding or Trade-marking of Timbers and Lumber

This is a subject which is being given much attention by several associations, societies, and manufacturers, some of which have adopted the practice, and is of interest and importance to architects, builders, and general consumers, many of whom have also given consideration to the subject. In addition to being treated within some of the publications mentioned elsewhere, the subject is dealt with in—

- (a) Proceedings of the National Lumber Manufacturers Association (5B1) for 1915:
 1. "Trade-marked Lumber, from the Standpoint of the Manufacturer," J. A. Gabel. Pp. 125-133.
 2. "Trade-marked Lumber, from the Standpoint of the Association," A. W. Cooper. Pp. 134-141.
 3. "Trade-marked Lumber, from the Standpoint of the Advertising Man," Everett Sisson. Pp. 142-149.
- (b) Proceedings of the National Lumber Manufacturers Association for 1916:
 1. "Why Architects and Engineers Want Branded Timber," Frank D. Chase. Pp. 186-192.
 2. "Why the Retail Lumbermen Want Identified Merchandise," F. A. Good. Pp. 193-208.
- (c) See "Specifications for Structural Timber" in 3A7a45 from which the following is also quoted:
 1. Branding as a Guarantee.

It has been suggested by Mr. Weiss, Director of the United States Forest Products Laboratory, that longleaf pine timber should be branded by the manufacturers. This is an excellent idea. Under present conditions the manufacturers are the only people who can positively say whether the timber is longleaf or not, as the standing loblolly, longleaf, and shortleaf timber exhibit the distinguishing differences in bark, leaves, and cones, not shown when cut into lumber.

After the trees are cut into lumber, it is practically impossible to check grades based upon botanical varieties.

Branding, without a clearly defined description of the several grades of wood, which can be checked by methods within the power of the purchaser, will depend entirely for its value upon the honesty and carefulness of the lumber manufacturer; but, with well-defined physical and chemical specifications, such as those in common use with iron and concrete, the branding can be checked by the purchaser when necessary and will facilitate inspection on the job.

- (d) The Oak Flooring Service Bureau (5J15) states that "Manufacturers of standard grades of oak flooring designate the grades and color on the back of every bundle."
- (e) A leaflet (not dated) of the Maple Flooring Manufacturers' Association states:

"This trade-mark MFMA on flooring is a guaranty of quality. It has been adopted as a means of identifying the flooring made by members of the Maple Flooring Manufacturers' Association. Architects, contractors, dealers and consumers can hereafter be sure of getting what they want when they specify or order Association Flooring. The individual factory is indicated by a number following the trade-mark. Trade-marking and advertising are twin pledges of good faith."
- (f) The following is quoted from Publication (Jan. 1, 1917) of the Southern Pine Association:
 1. Branded Timber.

"Proper service to buyers and users of yellow pine timber demands correct grading and the branding or marking of each stick of timber showing its grade. Variation in the individual character of different pieces of timber is responsible for the difference in strength. Structurally, some are much stronger than others. Owing to the confusion which frequently results in the proper classifying of timbers into longleaf, shortleaf, loblolly, etc., a new rule has been devised and recently adopted by the American Society for Testing Materials, and known among the trade as the "Density Rule," which classifies all southern pine timbers, irrespective of botanical species, into two classes, namely, "dense southern yellow pine" and "sound southern yellow pine. The Southern Pine Association recommends that all timbers be branded. All manufacturers and dealers are invited to brand their timber in accordance with the grades and classifications contained in this book."

- (g) In a folder received April 24, 1916 (undated), issued by the associated mills mentioned below, it is stated: "When you specify timbers bearing the brand of the Associated Calcasieu Longleaf Mills, you are not only assured strength, durability and long wear in every timber, but you are also guaranteed grading

according to the specifications of the Factory Mutuals, American Society of Testing Materials, American Railway Engineering Association, and the Southern Pine Association."

5D7 Standardization and Conservation

These comments, of course, are quite independent of any reference made elsewhere, principally under the A and B divisions, to the important work along these lines being done by the Forest Service and the Committees and Associations which cooperate with it, not only as concerns structural lumber, but the other utilizations of forest products.

- (a) Concerning these subjects the two extracts which follow from the Proceedings of the National Lumber Manufacturers Association are of especial interest:

1. In 1915 the Committee on Standardization reported as follows—

"A previous committee on standardization of lumber sizes made a report giving the various sizes which are standard in the different lumber-producing localities, but no result toward having a single schedule of sizes adopted and made use of universally was obtained. The conditions now prevailing operate against such a benefit being obtained, and it seems as if we must wait until things become more favorable."

2. At the 1916 Convention it was:

"Resolved, That in the interest of efficiency, economy, and reasonable conservation, the National Lumber Manufacturers Association approves the manufacture of odd lengths in all forms of lumber where practical from a use standpoint, and urges the support of all manufacturers, wholesalers, and retailers in establishing firmly such practice."

- (b) It is also of interest to note that the American Railway Engineering Association (1A9c) maintains a Committee on Conservation of Timber Supply, recommendations of which Committee will be found printed in the "Manual," 1915, pp. 60, 61.
- (c) See Forest Circular No. 180 (5D1). "Lumber Saved by Using Odd Lengths," as a step not only in Conservation but in reduction of cost of building.
- (d) In "North Carolina Pine—Doubly Desirable for Flooring and Ceiling" (5J12b) is a description of the saving in material and cost due to this Association's standards for working these products with $\frac{1}{2}$ -inch allowance for tonguing and grooving instead of $\frac{3}{4}$ inch.
- (e) See "Grading Rules" of the Maple Flooring Manufacturers' Association (5J14) in which it is stated that modern perfected methods of manufacturing flooring produce a larger proportion of shorter lengths because the defects are cut out closer and that the sentiment in favor of conservation is strongly in favor of utilization to the greatest extent of the valuable woods used.
- (f) In the "Standard Specifications for Grades of Southern Yellow Pine Lumber," issued by the Southern Pine Association, 1917, it is stated, with respect to grading of flooring: "The (above) percentage of short lengths is customary, and in the interest of Conservation will be included, so far as practicable, in all shipments of mixed lengths."
- (g) In "California Redwood," 5H4a, in a chapter entitled "The Use of Redwood 'Short Lengths' is Highly Intelligent Economy," is a most illuminating discussion of the savings and advantages to be obtained by discriminating in favor of conservation and effect through the use of lengths and grades other than the longest and the "select."

5E1 Treatments of Woods: Preservatives and Fire-Retardants

(See, also, Wood Preservatives, Shingle Treatments, and Fire Retardants, 12D.)

(The subjects covered by this heading will also be found described in many of the publications referred to under 5D and 5G, and elsewhere. See also descriptions under 5A for activities of committees concerned with these problems and 5B1b for associations interested.)

- (a) United States Department of Agriculture: Publications listed by Forest Service and Forest Products Laboratories (5A1, under which are also described current activities).

1. Commercial creosotes, with special reference to protection of wood from decay. 1912. 38 pp., illus. (Forest Circular 206.) 10 cents.
2. Relative resistance of various conifers to injection with creosote. 1914. 43 pp., illus. (Agriculture Bulletin 101.) 15 cents.
3. Preservative treatment of poles. 1911. 55 pp., illus. (Forest Bulletin 84.) 15 cents.
4. A primer of wood preservation. (Bulletin No. 139.)
5. Strength and stiffness of natural and treated stringers. (Bulletin No. 286, Sept. 27, 1915.)
6. Specific heat of wood (dry-kiln operation, wood preservation, and distillation). 1912. 28 pp., illus. (Forest Bulletin 110.) 5 cents.
7. Estimation of moisture in creosoted wood. 1908. 7 pp., illus. (Forest Circular 134.) 5 cents.

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8. Experiments on strength of treated timber. Second edition, 1908. 31 pp., illus. (Forest Circular 39.) 5 cents. (In the tests the preservatives were creosote and zinc chloride, and the wood was from railroad ties of loblolly pine of Texas and western yellow pine.)
9. Preservation of wood. Pp. 196 to 205. (In Smithsonian Report, 1864.) Price of entire vol., cloth, 70 cents.
10. Recent progress in timber preservation. Pp. 427 to 440. Illus. (From Agriculture Yearbook, 1903.) 5 cents.
11. Report on condition of treated timbers laid in Texas. Feb., 1902. 45 pp., illus. (Forest Bulletin 51.) 10 cents.
12. Strength tests of structural timbers treated by commercial wood-preserving processes. 1915. 15 pp., illus. (Agriculture Bulletin 286.) 5 cents.
13. Tests of wood preservatives. 1915. 20 pp., illus. (Agriculture Bulletin 145.) 10 cents. (The results of testing 30 preservatives are given.)
14. Visual method for determining penetration of inorganic salts in treated wood. 1911. 5 pp., illus. (Forest Circular 190.) 5 cents.
15. Wood preservation in United States. 1909. 31 pp., illus. (Forest Bulletin 78.) 10 cents. (Describes various processes for treating wood.)
- (b) National Lumber Manufacturers Association:
 1. "Tests of Fire Retardants, with special reference to the Shingle Roof," Hermann von Schrenk and Arnold von Schrenk. Technical Letter No. 2. May 27, 1916.
 2. "Preliminary Report on Tests with Fire-Retardant Compounds on Wood," Hermann von Schrenk and Arnold von Schrenk. Proceedings, 1916, pp. 96-117; illus.
 3. See sections on "Fire Retardants" and "Wood Preservation" in "Timber for Structural Purposes," 5D441.
 4. See one of the series of Farm Bulletins referred to under 5G16, entitled "The Preservative Treatment of Farm Timbers."
 5. See other publications referred to under 5F (Piling), many of which also deal with treatments of woods.
- (c) National Fire Protection Association:
 1. "Uses of Wood in Building Construction." Committee Report. Data of tests on inflammability of untreated wood and of wood treated with fire-retarding compounds. 55 pp., illus. (3A3d36); also in Proceedings, 1915, pp. 106-158.
- (d) Inspection Department, Associated Factory Mutual Fire Insurance Companies:
 1. See "Dry Rot in Factory Timbers" (3A7a45). Contains a chapter on "Chemical Treatments to Prevent Rot," and one on "Penetration of Antiseptics."
- (e) American Railway Engineering Association:
 1. "Wood Preservation." Adopted Report of Committee, with specifications and illustrations, pp. 539-557; Manual, 1915.
- (f) American Wood Preservers' Association:
 1. Annual Reports contain many authoritative and helpful papers upon methods of protecting timbers from decay.
- (g) American Society for Testing Materials:
 1. See Report of Sub-Committee VI on Timber Preservatives, Proceedings, 1916 (1A4a), pp. 328-339.
 2. See "Tentative Specifications for Southern Yellow Pine Timber to be Creosoted," Proceedings, 1916 (1A4a), pp. 483, 484. Serial designation. D24-15T.
 3. See "Tentative Specifications for Southern Yellow Pine Piles and Poles to be Creosoted," Proceedings, 1916 (1A4a), pp. 485, 486. Serial designation D25-15T.
- (h) Southern Pine Association:
 1. "Southern Pine Manual—Standard Wood Construction," 1917 (5G21), contains information on "Creosoting," pp. 99-103.
- (j) California Redwood Association:
 1. "The Test by Fire." Leaflet on the remarkable quality of California Redwood; illustrated.
- (k) West Coast Lumbermen's Association:
 1. "Structural Timber Handbook on Pacific Coast Woods," copyrighted 1916 (5G2j1), contains information on "Creosoting Douglas Fir."
- (l) Association of Creosoting Companies of the Pacific Coast:
 1. "Creosoting Douglas Fir Bridge Stringers and Ties without loss in Strength," Feb. 1916, 27 pp., contains tables, diagrams, and illustrations.
- (m) See "Tests of Timber Beams," Arthur N. Talbot. Bulletin No. 41, University of Illinois Experiment Station, 1910 (3C2a2); contains information on "Treated Timbers."
- (n) See "Preservation of Structural Timbers," Howard F. Weiss. 1915.
- (o) "Mechanical Engineers' Handbook," Lionel S. Marks, 1916.
 1. "Timber Preservation," H. von Schrenk; pp. 580-583.
- (p) "Building Construction and Superintendence," Part II, Carpenters' Work, F. E. Kidder, 1915.
 1. "Methods of Preserving Timber," pp. 35-37.
- (q) "Fire Prevention and Fire Protection," J. K. Freitag.
 1. "Fireproof Wood," pp. 260-262.
- (r) Journal of the Society of Constructors of Federal Buildings.
 1. "Preservative Treatment of Structural Timber and Piles," H. G. Richey, April, 1917, pp. 194-206.
- (s) Trautwine's Civil Engineer's Pocket-Book.
 1. Preservation of Timber, pp. 954-957.
- (t) "Lumber and Its Uses" (5B1f).
 1. Section on "Wood Preservation" describes prevention of decay, and brush, pressure, and open-tank methods of treatment.
 2. "Fire-Resistance" gives data on natural and artificial qualities, and describes "fireproofing" processes and fire-retardant paints. See Industrial Section for reference to "Conservo Wood Preservative" and "Cabot's Creosote Shingle Stains," p. 190, Samuel Cabot, Inc.

5E2 Treated Wood Flooring and Paving

(See, also, Wood Preservatives, Shingle Treatments, and Fire Retardants, 12D.)

- (a) National Lumber Manufacturers Association:
 1. "Creosoted Wood Block Paving," Walter Buehler; Technical Letter No. 1, May, 1916. Paper presented before the Arkansas Good Roads and Drainage Association, at Little Rock, Ark., April 12 and 13, 1916.
 2. "Standard Specification for Creosoted Wood Block Pavement," Technical Letter No. 8, Nov. 25, 1916. (14 p. Specification, separately backed, contains several diagrams.)
- (b) Southern Pine Association (See also p. xi):
 1. "Noise, the Nerve-Wrecker—How to Eliminate It in Your City." 20 pp. Illustrated book on wood block pavements.
 2. "What the Cities Say about Creosoted Wood Block Pavements," 24 pp., illus., being the opinions of civil engineers, paving experts, street commissioners and citizens' leagues, with comments by the United States Government.
 3. "Floors of Service, for Factories, Foundries, Machine Shops, Mills, Warehouses, Platforms, Bridges, Loading Docks, Stables, Barns, etc." 31 pp., illus. Deals with heavy service floors, with especial reference to the points of durability, safety, and practical economy.
 4. "Use of Creosoted Wood Blocks for Floors." Illus., reprinted from *The Iron Trade Review*, March 11, 1915.
 5. "Creosoted Wood Block Floors for Railroad Buildings." Illus., reprinted from *Railway Age Gazette*, December 17, 1915.
- (c) The West Coast Lumbermen's Association, and The Association of Creosoting Companies of the Pacific Coast:
 1. "Facts about Paving Bridge Floors." 6-page leaflet.
 2. "Creosoted Douglas Fir Paving Blocks." 46 pp. Contains tables, diagrams, and illustrations; revised Oct., 1915.
- (d) American Society of Municipal Improvements:
 1. "Specifications for Creosoted Wood Block Paving," adopted Oct. 13, 1916, copyrighted 1917. Any municipality which is represented in the membership of the Society by one or more city officials will be given free permission to use these specifications or any part of them upon application to the Secretary. 23 pp.
- (e) Southern Pine Association (See also p. xi):
 1. "Southern Pine Manual—Standard Wood Construction," 1917 (5G21). Contains a section, with diagram, on "Creosoted Wood Block Floors," pp. 126, 127.
- (f) "Lumber and Its Uses" (5B1f).

Section on Wood Block Paving gives "Essentials" and specifications.

5F Piling, Piers and Bulkheads (See, also, 12D)

(The subjects covered by this heading will be found also described in many of the publications referred to under other headings.)

1. United States Department of Agriculture:
 - (a) Preservation of piling against marine wood borers. 1908. 15 pp., illus. (Forest Circular 128.) 5 cents.
2. National Lumber Manufacturers Association:
 - (a) "Chicago's Four Million Dollar Pier." Technical Letter No. 3, June 12, 1916. Reprint from *Lumber World Review*, May 10, 1916.

- (b) "Interesting Comparison of Two Docks Recently Constructed in the City of Chicago, Illinois." Technical Letter No. 7, Sept. 5, 1916.
- (c) "Timber in Pier and Wharf Construction." A plain statement of facts and summary of data in regard to the use of timber in water-front structures, together with authoritative testimony from experienced engineers who have compared its fitness, durability, and cost with concrete in similar cases. Technical Letter No. 9, Nov. 30, 1916.

3. American Railway Engineering Association:
 - (a) "Wooden Bridges and Trestles." Report of Committee. Manual, 1915 (1A9c) and (5G3g1). Contains sections on piles and pile-driving, with principles of practice and specifications for same.
4. National Board of Fire Underwriters:
 - (a) "Building Code," 1915 (3A441). Contains: Section 19, "Wooden Piles."
5. West Coast Lumbermen's Association:
 - (a) "Structural Timber Handbook on Pacific Coast Woods." Copyrighted 1916, (5G2j1). Contains section on "Piling," with diagram, pp. 255-259.
6. Journal, Society of Constructors of Federal Buildings:
 - (a) "Pile Foundations," William S. Van Loan. Nov., 1914, Paper No. 165, p. 409.
 - (b) "Pile Tests at the Site of the Boston Appraisers' Stores," William N. Collier. Sept. 1915, Paper No. 187, p. 278.
 - (c) "Test Piles," Ernest G. Schurig. Nov., 1915, Paper No. 195, pp. 332-336.
7. The Building Trades' Handbook. See "Piles," pp. 157, 158, and "Spread Footings," p. 162.
8. See Kidder's Pocket Book, 1916. Contains section on "Wooden Pile Foundations," pp. 188-196.
9. American Civil Engineers' Pocket Book, 1916, M. Merriman. Contains section on "Piles and Pile-Driving," by Ira O. Baker and other sections on "Piers," "Docks," "Ferries," and "Harbor and River Works."
10. Mechanical Engineers' Hand Book, 1916, Lionel S. Marks. Also contains sections on "Piles" and "Driving" and other data.
11. Specifications issued by District Engineer, War Department, New Orleans, for "Piles, Wallings, Lumber, and Bulkheads" for Southwest Pass, Mississippi River; Jan. 16, 1917.
12. See Proceedings of the American Society of Civil Engineers. List of engineering articles of interest, published monthly.
13. See index to Journal of the American Society of Mechanical Engineers.
14. See index to the Journal of the Western Society of Engineers.

5C Wood in Buildings and in Structures in General

(See publications mentioned under Standing Timber and Manufactured Lumber, in many of which features of building construction are treated in connection with those main subjects.)

(See all subdivisions for separate features of construction and for accessories and devices.)

5C1 Information Obtainable

- (a) See, in addition to those elsewhere mentioned, the following publications of the National Lumber Mfrs. Association (5B1):
 1. "The One-Story School-House Idea," F. Leather. (Prepared in cooperation with the United States Bureau of Education (5B1c). Feb., 1917. Contains 56 pages of valuable data on this type of school building, with a list of over one hundred one-story schools in America, and many plans and other illustrations. Includes technical suggestions and data for architects, fire-resistive wood construction, and discussions of heating, ventilation, and other subjects and is an important publication for every one interested in the study of one-story buildings as compared with those of greater height.
 2. "Your Garage—How to Build it." November, 1916. 16 pp. Contains floor-plans and elevations. 10 cents. (5B1c.)
 3. "John Smith's Garage" (5B1c).
 4. "Wood Construction in Relation to Fire Losses" (5B1c).
 5. "The Shingle Roof" (5B1c).
 - (aa) See "Lumber and Its Uses" (5B1f), which contains, among others, elsewhere referred to, sections on the "Uses of Lumber," "Structural Timbers," "Lumber Prices," and "Permanent Advantages of Wood."
 - (b) See among others the following publications of the National Fire Protection Association listed under 3A3a to h:
 1. "Mill Construction Buildings," C. E. Paul, (3A3d32a).
 2. "Requirements for Standard Mill Constructed Building," Proceedings, Vol. 12, p. 103, and Vol. 21, 1917.
 3. See "Warehouses, Construction and Protection," C. H. Patton, Proceedings, Vol. 14, p. 125.
 4. Read Index 1916, for list of all subjects covered in the printed records of the N.F.P.A., many of which pertain to the varied uses of wood in general building construction.
 - (c) See Crosby-Fiske-Forster Hand Book of Fire-Protection. (Sixth edition now in preparation.)
 1. "Slow-Burning Construction: Recommendations for Mill Construction."
 2. "Improvements for Existing Buildings."
 - (d) See "Fire-Prevention and Fire-Protection," J. K. Freitag.
 1. "Slow-Burning or Mill Construction," Chap. IV. Contains description and typical diagrams, pp. 69-112.
 - (e) See Kidder's Pocket Book, 1916:
 1. "Wooden Mill and Warehouse Construction," A. P. Stradling, Supt. of Surveys, Philadelphia Fire Underwriters' Association, Chap. XXII.
 2. "Strength of Wooden Columns." Tables of safe loads, metal caps and bolsters for wooden columns, pp. 448-454.
 3. Data on wooden beams, formulas and tables, working unit stresses for woods, pp. 627-647.
 4. For built-up wooden girders, trussed beams and types of roof trusses, see separate Sections.
 5. For strength and stiffness of wooden floors, with tables of load for floors and rafters, see separate Chapter referred to under 5J2.
 - (f) See Trautwine's Civil Engineers' Pocket Book, for strength of timber and wooden columns, and for price list and business directory.
 - (g) See "Building Construction and Superintendence," Part II "Carpenters' Work," F. E. Kidder:
 1. See Chapter II, "Wooden Framing, Ordinary Construction," pp. 89-166. Profusely illustrated with framing plans and diagrams, and describing walls, floors, partitions and roof construction.
 2. See Chapter VII, "Heavy Wooden Framing," pp. 668-741. Also fully illustrated and describing flooring, trusses, girders, and mill-construction in detail, with post caps, wall boxes, hangers, stirrups, and all accessories.
 3. See Form of Specifications (for woodwork, millwork, painting, finishing, and other parts of wooden building construction), Chap. VIII, pp. 742-810.
 4. See Part III, separate volume on "Trussed Roofs and Roof Trusses."
 - (h) See "Mechanical Engineers' Handbook, 1916," Lionel S. Marks:
 1. "Building Construction," pp. 1,264-1,304.
 2. "Industrial Buildings," Charles Day, pp. 1,317-1,333.
 - (j) See "Mechanical Engineers' Pocket Book," William Kent, for notes and tables on walls, floors, columns, and other data, pp. 1,385-1,394, "Construction of Buildings."
 - (k) See "The Building Estimator's Reference Book," Frank R. Walker, second edition, Feb. 1, 1917. Contains, in addition to sections elsewhere referred to, a complete treatise on "Rough Carpentry," Chap. X, including data on materials and labor required, costs in various parts of the country, pertaining to all forms of wooden construction and accessories.
 - (l) See Proceedings of the American Society for Testing Materials, Vol. XVI, Part 1 (1A4a):
 1. Report of Committee (D7) on Timber.
 2. See also Mr. von Schrenk's description under 5A2.
 - (m) See "American Civil Engineers' Pocket Book," M. Merriman:
 1. "Materials of Construction," Rudolph P. Miller, "Timber," pp. 360-370.
 2. "Masonry and Timber Structures," W. J. Douglas, pp. 651-702.
 - (n) See "Materials of Construction," Johnson.
 - (o) See "The Building Trades' Handbook" for information on Carpentry Joints; Balloon Framing; Joints in Joinery; Estimating Carpentry and Joinery; Weights of Floors, Partitions, and Roofs; Beams and Girders; Roof Trusses; Columns; Furring and Lathing.
 - (p) University of Illinois, Engineering Experiment Station (5C2a2):
 1. "A Study of Roof Trusses," N. Clifford Ricker. Bulletin No. 16, 1908. 15 cents.
 - (q) Southern Cypress Manufacturers' Association:
 1. See the volumes of "Cypress Pocket Library," covering all uses for cypress (5H10a).
- For references to the use of yellow pine in building construction, see the Industrial Section; p. 186, Southern Pine Association.
- For information on oak, its characteristics and effects, see Industrial Section, p. 185, The American Oak Manufacturers' Association.

5C2 Practice Recommended and Suggested by

- (a) United States Department of Agriculture, Forest Service and Forest Products Laboratory:
 1. See such of the publications, which are listed under 5D1, as may apply to this subdivision.
- (b) United States Bureau of Mines:
 1. "Magazines and Thaw Houses for Explosives." Technical Paper No. 18 (2A3c). 34 pp. text, data and diagrams.
- (c) National Lumber Manufacturers Association (5B1):
 1. See, in addition to those elsewhere mentioned:
 1. "Building Code Suggestions" (Fire Stops, Careful Workmanship, and Proper Selection of Materials as Safeguards in Frame Dwelling Construction). Technical Letter No. 4, Aug., 1916. Contains construction details.

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2. "Building Code Suggestions" (Chimneys, Flues, Smokepipes, and Fireplaces in Their Relation to the Fire Hazard in Dwellings, with Detailed Provisions for Incorporation in Municipal Building Codes). Technical Letter No. 5, Aug., 1916. Contains construction details.
3. "Economics of Concrete and Timber Factory Buildings," F. E. Davidson, President Illinois Society of Architects. Technical Letter No. 6, Sept. 2, 1916.
4. "Heavy Timber Mill Construction Buildings," C. E. Paul. Engineering Bulletin No. 2, May, 1916 (5B1b). Contains chapters on: Mill Construction Defined; Exterior Walls, Fire Walls, and Enclosures; Floors; Posts or Columns; Roofs; Fire Protection; Cost of Mill Construction Buildings; Standard Mill Construction; Quality and Kind of Timber Used; Formulas for Design in Mill Construction (with table of working unit stresses). 67 pp. 50 cents.
5. Helpful suggestive bulletins on "Rural Architecture" (5B1a). The ten issued to date bear the following titles:
 - (a) Dairy and General-Purpose Barns; (b) Teachers' Cottages; (c) Poultry Houses; (d) Farm Residences; (e) Implement Sheds; (f) Ice Houses; (g) Silos; (h) Grain Storage Buildings; (j) Swine Houses; (k) The Preservative Treatment of Farm Timbers.

These publications are of especial interest and value to all architects concerned with the development of rural or suburban properties along practical, scientific, and harmonious lines. The publication of these Bulletins covering different farm units is most commendable as a distinct step in the elevation of the standards obtaining in these so frequently neglected types of structures. The reported demand for these publications is indicative of the interest aroused on the part of architects and others desirous of developing a finer type of rural architecture.
6. "Teachers' Cottages," R. S. Kellogg, in coöperation with the United States Bureau of Education, April, 1916 (5B1a). 31 pp., with illustrations of foreign and American accommodations for teachers and a valuable list of articles and publications for reference.
- (d) National Board of Fire Underwriters:
 1. "Building Code," 1915 (3A4d1). (See description by Mr. Woolson under 3A4.) Will be found to offer invaluable suggestions and assistance on all features of construction both generally and specifically. In addition to buildings in general and all parts of their construction, the following are separately treated: Classification of Buildings, Ordinary Timber Construction, Mill Construction, Frame Buildings, Structural Timber, Working Stresses of Structural Timber, Allowable Loads, and Fire Stopping.
 2. "Dwelling Houses," 1916 (3A4d3). (See description by Mr. Woolson 3A4.) Contains sections on "Frame Dwellings," "Fire Stopping," "Floor and Roof Construction," and others of interest. See index to same.
- (e) National Fire Protection Association:
 1. "Field Practice: Inspection Manual." See description 3A3d1.
 2. "Structural Defects: Suggestions for Their Elimination and Protection" (particularly with reference to safeguarding existing features) (3A3d32b).
- (f) Inspection Department, Associated Factory Mutual Fire Insurance Companies:
 1. See "Anchorage of Roofs" (3A6a1) for detail drawings and recommendations for securing wooden roofs.
- (g) The American Society for Testing Materials:
 1. Tentative specifications for "Selected Structural Douglas Fir Bridge and Trestle Timbers," Proceedings, 1916 (1A4a), pp. 479-482. Serial designation D23-16T.
- (h) The Associated Metal Lath Manufacturers (See, also, pp. 162-167):
 1. See "Metal Lath Handbook." Contains descriptions and detail drawings for "Protection of Steel Beams in Slow-Burning or Mill Construction;" "Fire Stops;" and "Mill Construction Buildings Protected by Metal Lath and Plaster."
 2. Illustrations from the Metal Lath Hand Book, showing details of ceiling construction and giving important recommendations on the weight of metal lath will be found in the Industrial Section on pp. 162-167.
- (j) West Coast Lumbermen's Association:
 1. "Structural Timber Handbook on Pacific Coast Woods," copyrighted 1916, 289 pp. Contains description of Pacific Coast Woods, specifications, tables for beams and floors, safe loads, diagrams and illustrations. \$1.
 2. "The Douglas Fir Silo," 24 pp., illus.
- (k) Association of Creosoting Companies of the Pacific Coast:
 1. "Structural Timber Handbook."
 2. "Strength Values for Structural Timbers."
 3. "The Douglas Fir Silo."
- (l) Southern Pine Association (See, also, p. 186):
 1. "Southern Pine Manual: Standard Wood Construction," 1917 (fifth edition). Contains, in addition to sections elsewhere referred to, diagrams, tables, specifications, grades of timbers, and data relating to beams, columns, floors, partitions, etc. 128 pp. Leather bound, \$1.
2. "Implement Sheds," 11 pp. Contains: Table Showing Floor Space and Height of Space Required to House Common Farm Implements.
3. "Service and Economy in Building," 23 pp., illustrated.
4. "The Home-Built Garage," 16 pp., illustrated.
- (m) California Redwood Association:
 1. "California Redwood on the Farm," 38 pp., illustrated. Contains descriptions of many uses and recommendations for painting or staining this wood. See reference under "Shingles," 5K.
 2. "The Home of Redwood." Illustrating and describing exterior and interior of building erected at the Panama-Pacific International Exposition by this Association, L. C. Mulgardt, architect.
- (n) Arkansas Soft Pine Bureau:
 1. "How to Build," 24 pp., with illustrations of the wood, and diagrams of framing construction and of exterior wooden walls, with other recommended practice in frame construction.
- (o) White Pine Bureau (See, also, p. 184):
 1. "White Pine in Home-Building." A book of 35 pages, describing the qualities, availability, and cost of White Pine, with many illustrations of attractive exteriors with "close-up" views of entrances, fences, and other features.
 2. The White Pine Series of Architectural Monographs. These publications, especially prepared for architects, under the direction of Mr. Russell F. Whitehead, are unusually interesting and suggestive as exemplifying the artistic and lasting qualities which may be obtained through the use of wood in the construction of buildings and in the embellishment of the structures and their surroundings. These Monographs were issued to present classified illustrations of wood construction critically described by representative American architects, the pictorial side being made the dominant feature and the example being selected for their general attractiveness. Beginning with July, 1915, nine volumes as follows have been issued to January, 1917. Copies of current issues may be had upon application to Mr. Whitehead, the Editor.
 - Vol. 1, No. 1, Colonial Cottages. Text by Joseph Everett Chandler.
 - Vol. 1, No. 2, New England Colonial Houses. Text by Frank Chouteau Brown.
 - Vol. 1, No. 3, Farm Houses of New Netherlands. Text by Aymar Embury II.
 - Vol. 11, No. 1, Houses of the Middle and Southern Colonies. Text by Frank E. Wallis.
 - Vol. 11, No. 2, Domestic Architecture in Massachusetts. Text by Julian Buckley.
 - Vol. 11, No. 3, Early Houses of the Connecticut River Valley. Text by Richard B. Derby.
 - Vol. 11, No. 4, A Suburban House and Garage. Report of Jury of Award.
 - Vol. 11, No. 5, Old Woodbury and Adjacent Domestic Architecture in Connecticut. Text by Wesley S. Bessell.
 - Vol. 11, No. 6, Colonial Architecture of the Eastern Shore of Maryland. By Charles A. Ziegler.
- (p) Carnegie Steel Company:
 1. See "Pocket Companion," Jan. 1, 1916, for Allowable Uniform Loads for Wooden Beams and Columns of various woods, Specific Gravities and Weights, and other tables.
- (q) Jones & Laughlin Steel Company:
 1. See "Manual" for Architects, Engineers and Contractors, 1916, for Allowable Uniform Loads for Wooden Beams and Columns of various woods, Specific Gravities and Weights, and other tables.

5G3 Standards Adopted

- (a) "Building Codes." The mandatory provisions of all Codes, state or municipal, must first govern construction in each locality, as mentioned under 4B3a.
- (b) See also 4B2b, and the publications of the National Lumber Manufacturers Association mentioned under 5G2c1 and 2, for reference to the Building Code recommended by the National Board of Fire Underwriters as a proposed standard.
- (c) By the National Board of Fire Underwriters (recommended by the N.F.P.A.):
 1. "Hose Houses for Mill-Yards: Construction and Equipment," (3A3a13).
- (d) By Inspection Department, Associated Factory Mutual Fire Insurance Companies:
 1. See 5D3d2 for small illustrations and brief reference to standard mill and factory construction.

- (e) By American Society for Testing Materials:
 1. Standard Specifications for Yellow Pine Bridge and Trestle Timbers. Serial designation D10-15.
 2. See Standard Definitions of Terms (5D3a1).
- (f) By Associated Mutual Fire Insurance Companies of New England:
 1. "Standard Mill Construction," shown in Report V, issued by the Insurance Engineering Experiment Stations under direction of Boston Manufacturers' Mutual Fire Insurance Co. Illustrated and described in Chapter VIII of 5G2c4. Report now obtainable from the Associated Factory Mutual Fire Insurance Companies (3A7c), by whom the work of the Experiment Station has been taken over.
- (g) By American Railway Engineering Association:
 1. "Wooden Bridges and Trestles" (5F2a), Manual 1915, pp. 219-246. Contains sections on Standard Defects of Structural Timber; Standard Names for Structural Timbers; Standard Specifications for Southern Yellow Pine Bridge and Trestle Timbers; Standard Heart Grade, Longleaf Yellow Pine; Standard Grade, Longleaf and Shortleaf Yellow Pine; Standard Specifications for Douglas Fir and Western Hemlock Bridge and Trestle Timbers.
 2. See Grading of Lumber (5D3b).
- (h) For dividing of floor areas, types of partitions, stair enclosures, and other features of industrial buildings, see "Universal Safety Standards," 1914. Compiled under the direction of and approved by the Workmen's Compensation Service Bureau, New York.
- (j) By Underwriters' Laboratories:

List of appliances inspected for accident hazards, first issue July, 1916, revised, January, 1917, covers a variety of safety appliances which are regularly inspected and labeled under the Underwriters' Laboratory label service. This work is carried forward in cooperation with the Workmen's Compensation Service Bureau.
- (k) For mechanical post cap and girder supports and other appliances and materials inspected and labeled or approved, with names of the articles and manufacturers, see:
 1. List of Inspected Mechanical Appliances (3A6b).
 2. Approved Fire Protection Appliances, Oct. 1916 (3A7a3).

- (k) See all references in N.F.P.A. Index to "Uniform Requirements."
- (l) For wood cores in fire doors and shutters, see the various publications mentioned under 4C3.
- (m) For wooden tanks, see 4D5.

5G4 Some Wood-Construction Accessories

- (a) Very important, with respect to the reductions of shrinkage in construction when open and the cracking of plaster when closed, is the consideration of post caps, hangers and other devices designed, not only for structural support, but to overcome some of these defects. Reference to these accessories will be found in many of the publications listed in this issue and also as follows:
 - (b) For Floor Hangers, Roof Connections, and Devices, see 4D4.
 - (c) For Scuppers, Inserts and Devices, see 4C4.
 - (d) Pulleys. This is an important question in connection with millwork. In addition to the finish of the article, so much depends upon the construction and size—determined by the use, the area and weight of sash, size of box and other considerations. The matter of standardization has been carefully worked out by the Columbian Hardware Co.
 - (e) "Nail Knowledge," Oct. 2, 1915, and "More 'Nail Knowledge,'" W. T. Flanders, *American Lumberman*, Nov. 27, 1915. Articles of much interest in connection with the use of wood and the lasting qualities of nails used.
 - (f) For correspondence concerning lathing nails, see 5M3.
 - (g) For information on self-releasing fire-exit latches, see Industrial Section, p. 147, Vonnegut Hardware Co.
 - (h) For Lightning Protection, see 4G.
 - (j) The use of units individually applied for "grounds" instead of plugging walls for continuous wooden stringers and for laying of "sleepers" for wooden floors is receiving the attention of manufacturers, as evidenced by circulars and catalogues distributed. See same for information. These are also referred to in Report of Committee on Manufacturers and Materials in *Journal of Society of Constructors of Federal Buildings* February, 1916.

5H Exterior and Interior Wood-Finish, Veneering and Finishing

(See, also, Painting, Varnishing, and Finishing in General, 12E.)

United States Department of Agriculture (Forest Service):

- (a) "Sugar Pine." Professional paper, Bulletin No. 426, 15 cents. Describes the qualities of this as an important wood in the manufacture of special and general millwork.
 - (b) "Veneers" (statistics and method of production), 1906, 6 pp. (Forest Circular 133), 5 cents. 1909, 23 pp. (Forest Products 5), 5 cents. 1910, 6 pp., 5 cents. 1911, 8 pp., 5 cents.
 - (c) "Circassian Walnut," 1913, 12 pp., illus. (Forest Circular 212), 5 cents.
- (For Floors and Floor Finishing, see 5J.)
- 1. See "Lumber and Its Uses" (5B1f):
 - (a) Section on "Standard Sizes of Lumber" gives Association Standards for Flooring, Ceiling, Partition, Siding, Finish, Shiplap Boards, and Dimension Work.
 - (b) Section on "Permanent Advantages of Wood" treats of Availability, Strength Compared with Weight, Workability, Insulating Qualities, and Figure.
 - (c) Section on "Paints and Wood Finishes" describes: Preparatory Treatments, and gives Specifications of Master Painters for Exteriors, Interiors, Hardwoods, and Softwoods.
 - 2. Southern Pine Association (See also p. 186):
 - (a) "The Standard Moulding Book," 1916, 37 pp., illustrated with Patterns of Full-sized Mouldings and all forms of finish in Southern Yellow Pine.
 - (b) "Directions for Finishing Southern Yellow Pine," 19 pp., colored facsimiles of finished woods and other illustrations, including interiors, with notes on painting, staining, and varnishing of this wood.
 - (c) Service and Economy in Building (5G2n). Also similar in contents to (b) without the colored plates.
 - (d) See "Standard Specifications for Grades of Southern Yellow Pine Lumber." Contents described under 5D4f2.
 - 3. Gum Lumber Manufacturers' Association (See also p. 187):
 - (a) "Technical Information about Red Gum," (no date), 16 pp. Illustrating and describing the figure in this wood, with notes on the care of hardwood doors and trim.
 - (b) "Red Gum Facts" (no date), 13 pp. Illustrating and describing interior and other uses and with formulas for various finishes.
 - (c) For many illustrations and much illuminating information on processes of manufacture, methods of using, kinds of veneers and other data, see *Canadian Woodworker and Furniture Manufacturer* for April, 1917, being a Feature Number on Gum Lumber.

4. California Redwood Association:

- (a) "California Redwood," 70 pp., colored illustrations. Treating of the use of redwood for interior trim and offering many suggestions in addition to giving "Directions for Rare Finishes on Redwood." Eight large colored panels show in facsimile varying effects of grain also. See 5D7g for reference to discussion of lengths and selections.
- (b) "In the Home of Redwood" 5G2m2. The use of this wood in interiors is described and formulas are given for interior finishes.

5. Arkansas Soft Pine Bureau:

- (a) "Architects' Manual on Arkansas Soft Pine," copyrighted 1916, 62 pp., illus. Includes complete description of the wood as to Origin, Individuality, Physical Characteristics, Proper Uses, Proper Finishing, Painting Formulas, and contains table of Board Measure and 30 pages of full-sized drawings of all kinds of exterior and interior trim, frames, sills, rails, and Standard Molding Designs and Grading Rules for all forms of finish.
- (b) "Arkansas Soft Pine: Interior Trim," 18 pp., colored and other illustrations.
- (c) "Arkansas Soft Pine: How to Finish and Paint It," copyrighted 1917, 23 pp., illus.
- (d) "Not a House but a Home." Home Construction, Hints for the Layman; Description of Wood; Cottage and Residence Designs, with introduction of Aymar Embury II, architect. 36 pp.

6. West Coast Lumbermen's Association:

- (a) "Suggestions for the Finishing of Western Woods."

7. Society of Constructors of Federal Buildings:

- (a) "Fumed Oak," Chas. E. Morrell. *Journal*, Nov., 1915, Paper No. 198, pp. 342-343.

8. White Pine Bureau (See also p. 184):

- (a) "White Pine Specifications." This is an exhaustive treatise, in preparation, and now almost completed, to supply the information heretofore lacking with respect to "frame construction" and the grades of lumber. It has been designed especially for architects to assist them in specifying and to enable them to refer in the language of the lumber trade to the specific grades of white pine most economically adapted to various building uses.
- (b) See "Architectural Monographs," described under 5G2q2.

STRUCTURAL SERVICE BOOK

9. North Carolina Pine Association:
 - (a) "Architects' and Contractors' Reference Book on North Carolina Pine," 7 pp., illus. Contains information on the origin and nature of the wood, its adaptability, its use in connection with interior and exterior work and for various types of buildings, comparative cost, and colored illustrations of finish.
 - (b) "North Carolina Pine for Architects and Contractors," 15 pp., colored illustrations, of stained boards and illustrations of exteriors. Treats of the character of the wood, its exterior and interior use, its adaptability to staining and enameling, digest of grading rules, use of millwork for doors and sash, cost and availability.
 - (c) "Your Home Beautiful," 16 pp., colored illustrations of stained boards and colored interior views.
 - (d) "Planning the New Home," 24 pp. Contains colored illustrations of stained boards; exterior illustrations and floor plans of ten modern homes, together with information on the characteristics of this wood, its adaptability for every use, its cost, and digest of grading rules.
 - (e) "Architects' Reference Book," 16 pp., color plates.
 - (f) "Home Builders' Book," 24 pp., color plates.
 - (g) "N. C. P. Millwork Manufacturers," giving a list of same.
 - (h) "Inspection Rules," 24 pp. Contents noted under 5D4k1.
10. Southern Cypress Manufacturers' Association:
 - (a) "Cypress Pocket Library." Consists of 41 booklets covering all uses for Cypress (5G1q1). See index to same in Vol. 1.
11. See "Veneered Work in Building Construction," G. D. Crain, Jr. Article printed in "Veneers," September, 1916.
12. See Kidder's Pocket Book, 1916, in addition to sections elsewhere referred to.
13. See "Building Construction and Superintendence," Part II, "Carpenters' Work," F. E. Kidder. Contains, in addition to sections elsewhere referred to:
 - (a) Chapter III describes: Sheathing; Window-frames; Sashes; Store-front Construction; Window-glass and Glazing; Outside-door Frames; Superintendence.
 - (b) Chapter IV describes: Outside Finish in general; Eaves, Cornices, and Gutters; Gables; Water-tables, Corner-boards, and Belt-courses; Covering of Outside Stud Walls; Porches and Piazzas; Dormers; Skylights and Scuttles; Roofing.
- (c) Chapter V describes: Rough Work; Joiners' Work; Doors and Windows, Frames and Finish; Inside Blinds and Coiling Partitions; Bases and Wainscoting; Wooden Cornices, Built-up Beams, and Columns; Miscellaneous Interior Wooden Finish; Stairs; Fixtures and Fittings; Dimensions of Furniture.
- (d) Chapter VIII: "Specifications" for: Interior Finish; Painters' Work; also Notes on Painting Specifications.
14. See "The Building Estimators' Reference Book," 1917. Frank R. Walker. Contains, in addition to sections elsewhere referred to:
 - (a) Chapter XI: "Mill-Work and Interior Finish, Erection of Same;" treats of Methods of Estimating the Labor Cost for Erecting Exterior and Interior Mill-work and Finish.
15. See "Building Trades' Handbook." Contains, in addition to sections elsewhere referred to, information on Windows, and Outside and Inside Finish, with many illustrations.
16. For further information on the use of white pine for exterior and interior finish, with illustration of doorway to house at Bedford, Mass., see the Industrial Section, p. 184, White Pine Bureau.
17. For more detailed information concerning red gum, with illustrated effects and description of publications of the Red Gum Manufacturers' Association, see p. 187 in Industrial Section.
18. For greenhouse construction, see 12F6.
19. For description of oak and its uses, see Industrial Section, p. 185, The American Oak Manufacturers' Association.
20. For other information on materials to be used in finishing wood-work, see pages in the Industrial Section as follows:
 - (a) References to "Matheson White Lead," p. 195, Matheson Lead Company.
 - (b) Cabot's Old Virginia White and other products, p. 190, Samuel Cabot, Inc.
 - (c) Architectural Varnishes and Enamels and specifications for Wood Finishing, Murphy Varnish Co., pp. 188, 189.
 - (d) "R. I. W." "Hospital and Laboratory Enamel," Toch Brothers, p. 193.

5J Wood Floors and Finishes and Parquetry Work (See also Painting, Varnishing, and Finishing in General, 12E)

- (Treated wood flooring and paving referred to under 5E2.)
In addition to their inclusion in many of the publications elsewhere referred to, these subjects will be found treated in:
1. "The Building Estimator's Reference Book," Frank R. Walker. February 1, 1917.
 - (a) A complete section on wood flooring, pp. 1318-1381, gives quantities, costs, kinds of materials, methods of laying plain floors, laminated floors, hardwood and parquetry floors, and of scraping sanding, and complete finishing with several pages of illustrations of parquetry floors and wood carpets.
 2. Kidder's "Architects' and Builders' Pocket Book, 1916." (Revised edition in preparation.)
 - (a) Strength and Stiffness of Wooden Floors, Thomas Nolan. Chapter XXI. Includes framing plans, tables for plank flooring and all other kinds, illustrations of joist and beam hangers.
 - (b) See "Data on Lumber and Carpenters' Work," pp. 1472-1478.
 3. "Building Construction and Superintendence," F. E. Kidder. Part II, Carpenters' Work.
 - (a) Floors, p. 519 and following: Grading of Flooring, Weights of Flooring, Laying Flooring, Parquet Flooring, Parquetry Flooring, illustrated with full-size sections of flooring boards and otherwise.
 4. Suggested Codes of the N.B.F.U. (3A4d1).
 - (a) "Building Code, 1915." See section giving data on slope of floors in mill-construction and other floors for drainage of water, pp. 129-130.
 - (b) "Dwelling Houses." See Floor and Roof Construction, pp. 31-39, particularly the recommendations under Section 29 on "Wooden Flooring" for double floors and floors over fireproof construction, with notes on timber.
 5. See "Watertight Floors of Mill-Construction" (3A6a26). Also contains diagrams of flashings against walls and at columns.
 6. "Flooring—Hardwood." Standard Specifications (Specifications and General Notes), Building Data League (2A5a), March, 1917.
 7. Quarterly of the N.F.P.A. See "Index" to subjects, also:
 - (a) Unit System of Wood Flooring for Fireproof Manufacturing Buildings, C. H. Patton, Vol. 8, No. 1.
 - (b) Waterproofing Floors, Vol. 7, No. 4.
 - (c) Enclosures for Floor Openings, Vol. 8, No. 3.
 8. "Mechanical Engineers' Pocket Book," Wm. Kent. 1916.
 - (a) Floors, Strength of floors (planks), pp. 1390-1394.
 9. "Lumber and Its Uses" (5B1f).
 - (a) Hardwood Flooring—Kinds, Grades, Uses and Methods of Finishing.
 - (b) Standard Sizes of Lumber—Association Standards for Flooring.
 10. "Structural Timber Hand Book on Pacific Coast Woods" (5G2j1).
 - (a) See sections and tables on Laminated Floors and Mill-Floors.
 11. Publications of the Southern Pine Association (See also p. 186):
 - (a) "Standard Specifications for Grades of Southern Yellow Pine Lumber," 1917 (5D4g2). Contains sections on "Heavy Flooring" and on "Flooring," with full-size detailed and figured drawings and describes sizes of material in the rough and when surfaced and finished. Defines sizes, lengths, grades, crook, and gives a special clause for determining average of defects. Grades, as follows, defined: Edge Grain—A, B, C, D, and No. 1 common;—Flat Grain—A, B, C, D, No. 1. Common, No. 2, common and No. 3. Sheathing (or No. 3 Common Flooring); also refers to Standard Matched Flooring, Center Matched Flooring, and No. 1, Common Factory Flooring and Heart Face Edge Grain.
 - (b) "The Gulf Coast Classification of Pitch Pine Resawn Lumber and Sawn Timber," 1915 (5D4g3), gives list of sizes of flooring and defines grades as follows: Rift, Special (Crown and French Flooring), Prime (Heart Face), Standard (Genoa Prime), Merchantable, and Square Edge.
 - (c) "Yellow Pine—A Manual of Standard Wood Construction." (5G2m1.) See Properties of Yellow Pine Mill Floors and Laminated Floors and tables and other data on heavy floor construction.
 - (d) "Directions for Finishing Southern Yellow Pine Floors" (5H2b). See section on Finishing Southern Yellow Pine Floors; contains general directions and recommendations as to the wood, manner of laying and methods of finishing floors in residences.
 - (e) See 5D7f for note about short lengths in flooring.
 12. Publications of the North Carolina Pine Association:
 - (a) "Official Inspection Rules," January 25, 1917. Under "Flooring" gives description of the standard lengths and defines the grades, as follows: Flat grain (unless otherwise specified)—No. 1 Flooring, No. 2 Flooring, No. 3 Flooring, No. 4 Flooring; Rift—No. 1 Rift Flooring, No. 2 Rift Flooring. Also describes lengths (same as flooring) for "Factory Flooring and Roofers" and defines grading same as box lumber. Contains full-size detailed and figured drawings of standard gauges for flooring, ceiling, partition, factory flooring and spline.

- (b) "North Carolina Pine—Doubly Desirable for Flooring and Ceiling," 4-page folder, describes the method used in the working of this wood for these and similar purposes and quotes from Forest Service Bulletin No. 99, about the use of shortleaf pine.
For further reference to this publication see 5D7d under "Standardization and Conservation."
- (c) In "North Carolina Pine for your Home" is given a digest of grading rules adopted by the Association for all forms of finish including flooring.
- (d) In "North Carolina Pine, the Wood Universal" is given a similar digest.
13. In "Red Gum Facts" (5H3b) is a description of the process of kiln-drying and reference to this wood as flooring material as well as for its many other uses.
14. Publications of the Maple Flooring Manufacturers' Association:
 - (a) "Grading Rules—for Maple, Beech and Birch Flooring," Adopted September 24, 1913. Copyrighted and reproduction prohibited. Definitions given: The Clear Grade, the No. 1. Grade, The Factory Grade, Special Grades, Standard Measurement, Custom Governing Reinspection, Advantages of Standard Lengths.
 - (b) "How to Lay and Finish Maple Floors," 1915. Contains: Directions for Laying, Economy of End Matched Flooring, The Proper Nail to Use (with illustrations of kinds and methods), Scraping and Sanding, Directions for Finishing Floors (oil treatment, wax finish, and varnished floors), Repairing Waxed Floors, Staining Maple, Beech and Birch, Selection of Flooring.
 - (c) "Schoolroom Floors," 1915. A 16-page illustrated treatise.
 - (d) "Individuality in the Home," 1915. 14 pages of suggestions to home-builders with respect to flooring.
 - (e) See statement about branding under 5D6e and about short lengths under 5D7e.
15. Publications of The Oak Manufacturers' Association of the U. S. and the Oak Flooring Service Bureau:
 - (a) "Oak Flooring," Seventh Edition, 1915. Contains grading rules as follows: Quarter-Sawed—Clear, Sap Clear, Select; Plain Sawed—Clear, Select, No. 1 Common, Factory; also recommendations as to the use of different grades. Also contains, Standard Thicknesses and Widths, How to Arrive at the Amount of Oak Flooring Required, Standard Weights of Oak Flooring, Handling, Laying Oak Floors, with Directions for Kind and Spacing of Nails, Scraping, Finishing (oil, wax and varnish), Care of Oak Floors, and Economical Uses.
 - (b) "How to Lay Oak Flooring," Leaflet. (Not dated, received November 8, 1916.) Contains Grading Rules (changing factory grade of "Plain Sawed" to "No. 2 Common" but with definition as before), The Use of Different Grades, with detailed drawings of Two Ways to Deadend a Floor, Laying, Scraping, Care of Oak Floors.
 - (c) "Three-eighths-inch Oak Flooring—Its Commercial Worth in Old Houses," Leaflet with illustrations and descriptions contributing to this purpose, with the Names and Uses of Different Grades 3/8-inch Oak Flooring and 3/8-inch Oak Flooring vs. Carpets. (Not dated, received August 28, 1916.)
 - (d) See statement about branding under 5D6d.
16. Arkansas Soft Pine Bureau:
 - (a) "Architects Manual on Arkansas Soft Pine" contains Grading Rules for Flooring, and Heavy Flooring, with description of sizes when worked and drawings and photographic illustrations of flooring.
17. Southern Cypress Manufacturers' Association:
 - (a) In Vol. 1 of the Cypress Pocket Library it is recommended that porch floors should be of cypress.
18. Northern Pine Manufacturers' Association:
 - (a) In "Rules for the Grading of Northern Pine, Spruce and Tamarack Lumber," Association Standard Grades for Flooring define: A Flooring, B Flooring, C Flooring, D Flooring, and Farmers' Clear Flooring.
19. In "Heavy Timber Mill Construction Buildings" (5G24c) is a section devoted to floors, describing general construction with details of laminated floors, sizes of bays, methods of flashing, with tables of allowable floor loads and working stresses.
20. See various publications and recommendations of manufactures of floor finishes which are not here referred to, except as below, the intention being to give at this time the recommendations of the manufacturers of the floors themselves who are of course eminently concerned with the proper treatment and care of their products.
21. For statements with respect to varnish for floors see Industrial Section, pp. 188, 189, Murphy Varnish Company.
22. For references to oak flooring, see Industrial Section, p. 185, The American Oak Manufacturers' Association.

5K Shingles, Lathing and Wall-Boards

The subjects covered by this heading will be found included in a great many of the publications referred to under the other subdivisions.

1. See Forest Products—Lumber, Lath and Shingles. 1909, 63 pp. 5 cents; 1910, 45 pp., 5 cents; 1911, 45 pp., 5 cents. Department of Commerce, Bureau of the Census, compiled in cooperation with Department of Agriculture, Forest Service. (Discontinued, see 5D1d.) These are statistical summaries.
 2. Standard specifications for yellow pine shingles are included in the publication of the Southern Yellow Pine Association mentioned under 5D4g2, which also includes standards for lathing and Byrkit lath and gives a list of standard sizes of yellow pine laths.
 3. In "The Lumber Users' Guide" (No. 12) listed under 5D4h2, the use of Washington red cedar for shingles is touched upon—grades not given.
 4. In "California Redwood on the Farm," listed under 5G2o1, is a section devoted to redwood shingles and shakes, with interesting illustrations of split-strakes and diagrams for laying shingle and shake roof construction. Contains, also, a description of the grades and recommendations as to the manner of laying.
 5. For cypress shingles, see "Classification and Grading Rules for Cypress Shingles" p. 652 of 1915 "Manual" of American Railway Engineering Association. (1Agc.) Defines grades—Bests, Prints, Star a Star, Economy and Clippers and standards for quantities and inspection.
 6. See Pocket Library of Southern Cypress Manufacturers' Association Vol. 7, "Cypress Shingles (a 'Yes' Book);" Vol. 29, "Cypress Shingle House No. 1;" Vol. 34, "Shingle House No. 2."
 7. For red cedar shingles the Shingle Branch of the West Coast Lumbermen's Association adopted grading rules, effective June 25, 1916, entitled "Rite-Grade Grading Rules." See separate leaflet defining same.
Among the many other publications of this Shingle Branch are:
 - (a) "Distinctive American Homes of Red Cedar Shingles," 18 pp.
 - (b) "Bungalow Homes of Red Cedar Shingles," 18 pp.
 - (c) "Farm Buildings of Red Cedar Shingles," 18 pp.Each of these is attractively illustrated with perspective views, plans and diagrams.
 - (d) "Nails," a leaflet giving sizes and kinds to use for different forms of material, including shingles.
It also publishes a set of twelve "Bungalow Designs" (plans and elevations, specifications and bill of materials), based on the use of shingles.
8. In "Structural Timber Hand Book" published by the same Association (listed 5G27i) will be found several pages describing and

- of Oak Flooring, Handling, Laying Oak Floors, with Directions for Kind and Spacing of Nails, Scraping, Finishing (oil, wax and varnish), Care of Oak Floors, and Economical Uses.
 - (b) "How to Lay Oak Flooring," Leaflet. (Not dated, received November 8, 1916.) Contains Grading Rules (changing factory grade of "Plain Sawed" to "No. 2 Common" but with definition as before), The Use of Different Grades, with detailed drawings of Two Ways to Deadend a Floor, Laying, Scraping, Care of Oak Floors.
 - (c) "Three-eighths-inch Oak Flooring—Its Commercial Worth in Old Houses," Leaflet with illustrations and descriptions contributing to this purpose, with the Names and Uses of Different Grades 3/8-inch Oak Flooring and 3/8-inch Oak Flooring vs. Carpets. (Not dated, received August 28, 1916.)
 - (d) See statement about branding under 5D6d.
 16. Arkansas Soft Pine Bureau:
 - (a) "Architects Manual on Arkansas Soft Pine" contains Grading Rules for Flooring, and Heavy Flooring, with description of sizes when worked and drawings and photographic illustrations of flooring.
 17. Southern Cypress Manufacturers' Association:
 - (a) In Vol. 1 of the Cypress Pocket Library it is recommended that porch floors should be of cypress.
 18. Northern Pine Manufacturers' Association:
 - (a) In "Rules for the Grading of Northern Pine, Spruce and Tamarack Lumber," Association Standard Grades for Flooring define: A Flooring, B Flooring, C Flooring, D Flooring, and Farmers' Clear Flooring.
 19. In "Heavy Timber Mill Construction Buildings" (5G24c) is a section devoted to floors, describing general construction with details of laminated floors, sizes of bays, methods of flashing, with tables of allowable floor loads and working stresses.
 20. See various publications and recommendations of manufactures of floor finishes which are not here referred to, except as below, the intention being to give at this time the recommendations of the manufacturers of the floors themselves who are of course eminently concerned with the proper treatment and care of their products.
 21. For statements with respect to varnish for floors see Industrial Section, pp. 188, 189, Murphy Varnish Company.
 22. For references to oak flooring, see Industrial Section, p. 185, The American Oak Manufacturers' Association.
- (See also Wood Preservatives, Shingle Treatments and Fire-Retardants, 12D, and Lathing and Plastering, 11D6)
- illustrating the correct method of laying red cedar shingles, the kind and size of nail to use, and other recommendations. Also "Grading Rules for Red Cedar Shingles Which Have Been in Use Since 1908," as well as the "Rite-Grade" Grading Rules of the Shingle Branch of this Association, above referred to.
9. See "Architects' Manual on Arkansas Soft Pine" (5H5a) for drawings and grading rules of lathing, Byrkit lath, lattice and other finish.
 10. In "Rules for the Inspection of Hemlock Lumber," adopted by The Northern Hemlock and Hardwood Manufacturers' Association (5D4d1), the definitions are given, at length, of No. 1, and No. 2 Lath.
 11. In "Report of the Committee on the Uses of Wood in Building Construction" (5E1c1), see Part III, Investigation of the Relative Inflammability of Untreated and Treated Siding and Shingles.
 12. See "The Building Estimator's Reference Book," F. R. Walker, 1917, for estimating quantities of shingles, labor, nails and other features of construction.
 13. In "Building Trades Hand-book" is a treatise on shingles with illustrations and descriptions of laying, gauging, forming hips and valleys and table of quantities; also reference to lathing.
 14. "Building Construction and Superintendence," F. E. Kidder. Part 11, Carpenters' Work.
 - (a) Wall Shingling. (b) Shingled Roofs in General, 18 pages of descriptive matter about kinds and grading of woods, paper lining, laying, ridges and hips, valleys and flashings, and snow-guards, with various tables and diagrams. (c) Furring and lathing.
 15. See "Association Standard Grades," rules for the grading of northern pine, spruce and tamarack lumber of the Northern Pine Manufacturers' Association. In same is defined No. 1 White Pine Lath; No. 1 Mixed Lath and No. 2 Lath.
 16. See Current Comments (5M3) for some interesting correspondence on the subject of lathing.
 17. For illustrations and description of a wooden dovetailed lath (creosoted) imbedded in asphalt-mastic on a fiber-board backing, making a stucco or plaster-board, see Industrial Section, p. 196, the Bishopric Manufacturing Co.
 18. Shingles may be obtained already treated and stained, whether for "regular" effects or for "thatched roofs," for which see manufacturers' literature. For "Pamak" Fire-retardant shingle paints, see 12D5.
 19. For illustration and description of effects to be obtained by the use of creosote stains on shingles, see Industrial Section, p. 190, Samuel Cabot, Inc.

5L Recreation Facilities—Bowling-Alleys, Billiard Tables and Other Games

As wood is the principal material entering into the construction of games and other recreational facilities which are housed from the weather, and as many of them require and should receive proper consideration in planning on account of adequate provision which should be allowed for their accommodation in the structure, it has been thought well to touch upon the subject of space requirements for some installations here. Other recreational facilities for indoors and outdoors will be treated in subsequent issues.

1. In "Kidder's Pocket Book (1916)" and in some few of the other books referred to in various issues of the Journal will be found, under the Index, names of games and equipment required, and in the text brief descriptions, list of sizes and similar data pertaining to shuffle-boards, squash-courts, and other games.

2. In the Industrial Section of this issue will be found, on p. 159, authoritative figured installation drawings and measurements for bowling-alleys and lists of sizes of billiard tables and space-requirements as prepared by the makers themselves—the Brunswick-Balke-Collender Co.
3. It should be borne in mind that space-requirements given, while a liberal minimum for satisfactory playing, do not purport to provide space for spectators for whom, when desired, further space-allowance should be made. Columns, pilasters, chimney breasts and other projections should never be allowed to encroach upon the space required, nor to interfere with the player's enjoyment.

5M Current Comment

1. Activities to date, with respect to lumber and its uses structurally, are fully covered under descriptions given of the Forest Service, and of the various committees and associations at the beginning of this issue.

2. The following notation of corrections which should be made in the New York City Building Code is of interest:

Attention is called to incorrect values of working stresses for timber in compression across the grain, still printed and circulated (May, 1917) in the Code of Ordinances of the City of New York, Article 3, Section 51, as amended by ordinance adopted April 20, 1915, effective May 1, 1915. The values given are two or three times as high as they should be and are due to errors in transcribing manuscript, as explained to the undersigned by the Superintendent of Buildings of the Borough of Manhattan.

THOMAS NOLAN,

Chairman Committee on Materials and Methods.

3. In connection with the subject of lathing referred to under 5K, the subjoined correspondence between the Chairman of the Committee on Materials and Methods and a committeeman is of interest and will, it is hoped, lead to further discussion on this subject.

My dear Prof. Nolan: I am enclosing a copy of "Standard Rules of the Measurement of Plastering" as adopted by the Employing Plasterers' Association of this city.

These rules have not been formally approved by our Chapter (which has a committee appointed for the purpose of "standardizing" workmanship and materials), and I do not know what modifications, if any, would be demanded before our approval would be given, but the adoption of "standards" in any branch makes it almost impossible to get work done in accordance with the *architects'* specifications, if they *vary* from the adopted standard; for instance, I always specify three-penny, fourteen-gauge wire nails, 1½ inches long, for wood lath. The "standard" adopted by the plasterers and unions calls for three-penny, "fine," of sixteen gauge, which is not much better than a good healthy "pin" and is not heavy enough to make a good job—especially if *hard* pine lath are used which are liable to twist and pull out.

I have a fight on every job on this point—as the lathers do not like the larger nails (not so convenient to hold in the mouth)—and there are only about three-fifths as

many to the pound, making them cost more. However, I believe the standardization of workmanship and materials will be of great benefit, provided the standards adopted meet the architects' approval. Yours very truly,

My dear Mr.———:

I have your letter of February 28th, enclosing the copy of "Standard Rules of the Measurement of Plastering," adopted by the Employing Plasterers' Association of your city.

Of course, all of the so-called "standard rules," specifications, tests, etc., recommended by producers are not necessarily to be accepted by the profession: but "standards" approved by a society like the American Society for Testing Materials, I think, may be accepted by the profession without question, because that Society is made up of membership of both producers and non-producers, that is to say, of producers and manufacturers on the one hand, and of engineers and architects on the other hand. The A.S.T.M. Standard Specifications for portland cement and structural steel, for example, may well be approved and recommended by the architectural profession.

Yours very truly,

THOMAS NOLAN, *Chairman.*

5M4 Addenda

For further items of interest in connection with Wood Lathing, see "Uniform Lathing Specifications," described under 11D6l and many other references under that subdivision.

Also, as of especial interest in connection with wood work in general, see Serial No. 12, devoted to Paints and Painting, Glass and Glazing. Section 12B deals with Research, Tests and Paint Materials; 12D with Wood Preservatives, Shingle Treatments and Fire Retardants; and 12E with Painting, Varnishing and Finishing in General. In a great many of the publications listed under these sections and in the activities referred to there the characteristics, uses, treatment and finish of woods are constantly under consideration.

Serial No. 6

ELECTRICAL ISSUE

CONTENTS

The purpose this month is to place before the readers of the Journal a résumé of matters electrical applying to buildings, their construction and equipment. Practice in this respect has been standardized to an extent perhaps not excelled by any other science or industry. And yet improvement is constantly taking place. For some years the leading activities in the development of electrical

utilization within and around buildings have centered about the revision of the National Electrical Code, the requirements of which have long been recognized as affording the working basis necessary for a unison of purpose on the part of all interests in the electrical field.

The plan of presentation is revealed in the Index:

JUNE, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

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|---|--|
| 6A Electrical Societies, Associations and Allied Agencies. | 6G Telephones, Signaling Systems, Clocks and Bells. |
| 6B Others Having Important Electrical Committees. | 6H Illumination, Lighting Fixtures and Lamps. |
| 6C The National Electrical Code. | 6J Heating, Cooking and Other Appliances and Devices. |
| 6D1 The National Electrical Safety Code. | 6K Vacuum Cleaners. |
| 6E Apparatus, Appliances and Installations in General. | 6L Mechanical Equipment of Federal Buildings. |
| 6E4 Standard Symbols and Charts. | 6M Lightning Protection. |
| 6F Electric Elevators and Dumbwaiters. | 6N Electrolysis. |
| | 6O Electrical Specifications, U. S. Army. |

Electrical Societies, Associations and Allied Agencies

6A1 *American Institute of Electrical Engineers*

Secretary: F. L. Hutchinson, 33 W. 39th St., N. Y. C.

Publications:

- (a) *Proceedings.* Published monthly, in two sections. One section contains news and notices of interest to members, and the other contains technical papers, discussions, reports of committees and other matters of an engineering character. \$10 annually.
- (b) *Transactions.* Published annually, containing selected technical papers, discussions, and reports, and forming a permanent record of the progress of electrical engineering.
Existing bound volumes may be purchased by non-members at \$10 in paper; \$11.50 in cloth.
- (c) *Separate Papers and Discussions.* Certain of those contained in the *Proceedings* and *Transactions* can be furnished separately at 50 cents each.
- (d) *Standardization Rules.* Revised Edition.
Gives standard definitions of electrical terms, technical data, standard performance specifications, and tests of electrical machinery, standard voltages and frequencies, and general recommendations, as adopted by the Standards Committee and approved by the Board of Directors, June 30, 1915, to take effect July 1, 1915. Price 25 cents.
- (e) *Year Book.*

The Institute has technical committees covering practically the entire electrical field, those concerned with matters of interest structurally being Electric Lighting Committee, Standards Committee and Code Committee.

The work of the Standards Committee is of great value to the profession and to every user of electrical power. The main purpose of this Committee, hitherto aimed at in the rules, has been to draw up engineering definitions of terms, phrases, and requirements relating to electrical machinery and apparatus, so that the meaning of technical terms might be standardized among the members of the Institute. (See 6E3 for description of these Standardization Rules.)

6A2 *The Society for Electrical Development*

General Manager: J. M. Wakeman, 29 West 39th Street, New York City.

Public Information:

Issues no publications for general distribution. A possible exception to this is a reprint of "Useful Electrical Information for Architects, Contractors and Engineers." Copies furnished practising architects upon request.

The Society maintains, and through painstaking research work is constantly adding to, an extensive library of electrical information, including records of electric rates and data concerning engineering work, all of which material is carefully classified and filed for ready reference.

One of the Society's activities has been to cooperate

STRUCTURAL SERVICE BOOK

with the Wiring Committee of the National Electric Light Association and H. C. Cushing in preparing a special section of over fifty pages on "House Wiring" in the "Cushing Standard Wiring Handbook."

[NOTE.—While the general uses and advantages of electricity are known to all, it is impossible for anyone not in touch with the industry to know of the constant changes which are being made in the means of supply and the many improvements which are taking place in the means of its utilization. In planning electrical service it is always wise to consult with local electrical interests—the central station management, electrical or consulting engineers, and electrical contractors, of known reliability—as they are familiar with local ordinances, inspection rules, and terms of service, but the Society will gladly aid the architect and all builders in other directions.]

6A3 National Electric Light Association

Secretary: T. C. Martin, 29 West 39th Street, N. Y. C.

Publications:

- (a) Proceedings, and (b) Reports, issued annually.
- (c) The N.E.L.A. Bulletin, issued monthly, for members only and for distribution to institutions of learning, so as to be accessible to the many engineering students.
- (d) Handbooks, which are permanently valuable contributions to the literature of electricity and have received wide appreciation, not only from public utility companies and their employees, but from college professors and students in colleges and technical schools.
- (e) Booklets are issued from time to time through the commercial section of the Association, with the aim of promoting better conditions of service to the public.

Many other publications are issued, some of which will be found referred to under subdivisions later.

The National Electric Light Association was organized in 1885 to foster and promote the effectiveness of the service furnished by electric central station corporations engaged in the production, transmission, and distribution of electricity, in supplying the public with light, heat, power, and other forms of service.

At a very early stage the Association took part in the now universal "Safety First" movement, and is at present coöperating with the U. S. Bureau of Standards in the development of the National Electrical Safety Code.

The Association maintains a Lecture Bureau and is also one of the bodies represented on the Electrical Committee of the N. F. P. A. in charge of the National Electrical Code.

The engineering and attendant scientific and educational work of the Association is carried on through appropriate subdivisions or sections of the national organization known as the Technical and Hydro-Electric Section, the Commercial Section, the Accounting Section, and the Electric Vehicle Section, and through Committees, of which there are now about 70 with some 500 leading experts in their membership.

6A4 National Electrical Contractors' Association of the U. S.

Secretary: H. C. Brown, 41 Martin Building, Utica, N. Y.

Publications:

- (a) Standard Symbols for Wiring Plans, as adopted and recommended by the National Electrical Contractors' Association and the American Institute of Architects. Copies may be had without charge upon application to the Secretary of the Association, or to the Executive Secretary of the American Institute of Architects at The Octagon, Washington, D. C.
- (b) National Electrical Contractors' Association Standard Conduit Charts, showing standard sizes of conduits for the installation of wires and cables, adopted and recommended by the N.E.C.A.

of the U. S. and required by the National Electrical Code; completely illustrated with drawings of conduits, wires and cables at one-half full size; copyright 1912. These are mounted upon boards 21½ by 30, and may be obtained upon application to the Secretary, at a price of \$3. Postage additional.

- (c) *The National Electrical Contractor* is the official journal of this Association and covers a wide field in the electrical industry.

This Association was organized in Buffalo, 1901, by forty-nine progressive electrical contractors who were desirous of raising the standard of electrical contracting to the plane of a profession, and the objects were, in chief, to collect for electrical contractors and dealers important information which they could not get independently. The main objects are:

Committees exist to solve various problems for the members and allied electrical interests. The Association is represented on the Electrical Committee of the N. F. P. A. in charge of the National Electrical Code and is also represented in all the important electrical societies and organizations.

6A5 National Board of Fire Underwriters

See March Journal, Serial No. 3A4, for description of activities and list of publications, and see, also, 6C.

6A6 Local Underwriters' Associations

See March Journal, Serial No. 3A5, for description, and 3A2 for coöperation with architects. For the convenience of architects, engineers, and constructors, a colored map of the United States, 28 x 14 inches, is issued by Ream, Ives & Wrightson, Insurance Brokers, 24 Broad Street, New York City. It shows the territory under the jurisdiction of the various boards and bureaus making electrical inspections and fire insurance rates. Price, \$2.50.

6A7 Underwriters' Laboratories, Electrical Department

For other descriptions of activities and publications see 3A6 and previous issues of the Journal, also see Industrial Section, p. 141.

Electrical Publications:

- (a) List of Inspected Electrical Appliances (see Standards Adopted and Progress Reported, 6E3d).
- (b) Electrical Data (see Information Obtainable, 6E1x).
- (c) Standard on Rubber-Covered Wires and Cords (3A6f).
- (d) Standard on Cabinets and Cut-out Boxes (3A6j).
- (e) Standard on Flexible Steel Armored Cables.
- (f) Standard (Tentative) for the Construction and Installation of Materials for Lightning Rod Equipments (3A6k).

NOTE.—(a) and (b) revised semi-annually; sent free upon application. (c), (d), (e) and (f) for sale in printed form at \$1 per copy. Other standards in mimeographed form, some of which will be printed later.

The testing of electrical appliances and electric wiring materials was the first work undertaken by Underwriters' Laboratories; it has always been a very important division of the activities of the institution. Two electrical laboratories are maintained, one in Chicago and the other in New York. Underwriters' Laboratories' Councils are bodies of experts having extensive field experience, as relates to fire and accident protection, with the products upon which Underwriters' Laboratories is called to pass. The Councils review and criticize reports on laboratory tests on products that have been submitted for investigation and listing, and the members are called upon to register their approval or disapproval of the recommendations of the Laboratories' engineers before any product investigated can be listed as standard. In various other advisory capacities these bodies also serve the institution. There are three Councils: The Fire Council, the Casualty Council, and the Electrical Council.

Underwriters' Laboratories' Electrical Council consists of forty-eight prominent electrical engineers and inspectors, including, in addition to Underwriters' representatives, two representatives of the Federal Government, a representative of the Hydro-Electric Power Commission of Ontario, and engineers and inspectors from municipalities, New York and Chicago being among these.

As has been pointed out in previous issues of the Journal, suitable supervision of the factory output and a comprehensive field follow-up are employed on all products carried as standard in the Laboratories' lists. The Label Service, described in detail in the January, 1917, Journal, is the system of supervision follow-up most extensively employed in the electrical industry, as in other industries. Electrical appliances and materials passed by Underwriters' Laboratories may be identified by means of Underwriters' labels on the goods themselves, except in relatively few instances where labeling is impracticable. The labeling may consist of a marker attached or of a permanent marking in the material, the latter being known as die labeling.

For further and more detailed information in this issue concerning Underwriters' Laboratories see 6C2 and Industrial Section, p. 141.

6A8 Associated Factory Mutual Fire Insurance Companies

For description of same and of Inspection Department and for complete list of publications see March Journal, Serial No. 3A7. For the two publications especially relating to electrical subjects see "Standards Adopted" 6E3e. Of these the "Electric Rules," which is the National Electrical Code illustrated by cuts and with explanatory footnotes, has been adopted as a textbook in several educational institutions throughout the country.

The Associated Factory Mutual Fire Insurance Companies are represented on the Electrical Committee of the N.F.P.A.

6C The National Electrical Code

EVOLUTION OF THE CODE

(a) The position occupied by the National Electrical Code is a unique one. So far as the rules themselves go, they are but little more than recommendations. But they are so wisely drawn and specify so well what is necessary for safety in electric wiring that all insurance and electrical interests accept their recommendations with seldom a question, while municipal boards enforce them as ordinances.

The New York Board of Fire Underwriters issued, in October, 1881, the first printed requirements on electric wiring. A few days later the Boston Manufacturers' Mutual Fire Insurance Company issued a similar document. Early in 1882 both of these organizations issued circulars containing a few rules on electric wiring. Soon thereafter the National Board of Fire Underwriters adopted the requirements of the New York Board. In this same year (1882) the Boston Board of Fire Underwriters issued a set of rules, as did the New England Insurance Exchange in 1885.

In the first part of the year 1890, six of the insurance organizations issued quite complete sets of rules relative to the installation of electric wiring. In 1891 the National Electric Light Association adopted a code of wiring rules prepared by this bureau, and in 1892, a convention of

6A9 National Fire-Protection Association

For complete description and list of all publications see March Journal 3A3.

The Biennial revision of the National Electrical Code is now in the hands of the Electrical Committee of the N.F.P.A. as explained in the introduction to the Code under 6C. The contemplated 1917 revision did not take place for the reasons stated, in the Report of this Committee to the Convention of the N.F.P.A. in Washington May 8-10, 1917, as follows:

(a) Report. "Owing to the injunction granted without a hearing by the New York Court at the prayer of a manufacturer of fuses against all the members of the Electrical Committee, the regular biennial open meeting of the Committee was not completed."
"The preliminary injunction has been dissolved and it is hoped to complete the work of the meeting at an early date."

F. E. CABOT, Chairman.

6B Other Electrical Associations

American Electric Railway Association, New York City; Associated Manufacturers of Electrical Supplies, New York City; Association of Edison Illuminating Companies, San Francisco, Cal.; Association of Iron and Steel Electrical Engineers, McKeesport, Pa.; Association of Railway Electrical Engineers, Chicago, Ill.; Canadian Electrical Association, Toronto, Canada; Electrical Manufacturers' Club, Syracuse, N. Y.; Electrical Supply Jobbers' Association, Chicago, Ill.; Electric Power Club, Chicago, Ill.; Jovian Order, St. Louis, Mo.; National Association of Electrical Inspectors, Concord, Mass.; Institute of Electrical Contractors, New York City.

Other national associations having committees concerned with the use of electricity in buildings are:

American Society for Testing Materials (1A4), American Railway Engineering Association (1A9), American Society of Mechanical Engineers (Serial No. later), Western Society of Engineers, with headquarters at Chicago, maintains an Electrical Section administered by an Executive Committee.

(For educational institutions in connection with research work in electricity and testing facilities, see 1B3a.)

(See also other Associations listed under 12L.)

insurance men met in New York and made such revisions in the rules which had been adopted by that body as seemed wise. At a second meeting in December of the same year, attended by representatives from insurance boards all over the United States and from many sections of Canada, the Underwriters' National Electrical Association, a permanent organization was effected and an Electrical Committee appointed, consisting of electricians in the employ of insurance interests, whose duties were to be the care of the rules, the making of tests, and the giving of information and advice to the Association.

At the next meeting of the Underwriters' National Electric Association in Chicago in 1893, and at a subsequent meeting in Boston the same year, the rules were revised again. In February, 1894, they were adopted by the National Electric Light Association; before the close of the year, by six additional insurance boards, coming thus into use by insurance inspectors all over the United States. The plan was then adopted of having all the printing of the rules done by the National Board of Fire Underwriters and having no changes made in rules except through this Board.

By 1895 the rules had been adopted practically by all the Underwriters' associations, forty of which were using copies of them printed from the same type. Moreover, they had been accorded the approval of many electrical manufacturers and prominent central-station men, and

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had been incorporated into the ordinances of fifteen or twenty leading cities.

In October, 1895, a communication was sent out on behalf of the National Electric Light Association, suggesting a joint conference, to be composed of delegates from the American Institute of Electrical Engineers, the American Street Railway Association, the National Board of Fire Underwriters, the American Institute of Architects, the International Fire Chiefs' Association, the American Bell Telephone Company, the Western Union and the Postal Telegraph Companies, the General Electric Company, the Westinghouse Electric and Manufacturing Company, the National Electric Light Association.

From this meeting a National Conference on Standard Electrical Rules was organized in 1896, and a Committee appointed to amend and codify the rules. This Committee decided that the rules promulgated by the Underwriters' National Electric Association offered the best basis for a standard set of rules. That Committee prepared a number of suggestions for changes in and additions to the Underwriters' rules. Most of these suggestions were adopted and the Underwriters' National Electric Association immediately set to work to revise and recodify the rules.

The revised rules were approved by the Code Committee of the National Conference and promptly indorsed and adopted by the National Electric Light Association and other interested organizations.

Thus there came into existence in 1897 the "National Electrical Code."

The assistance which Mr. C. M. Goddard, of Boston, rendered in the creation of the Code attracted such wide attention to his enthusiasm and ability that when the Underwriters' National Electric Association was formed he was made its secretary. Because of the exercise of these same qualities, he was in 1911 retained in the Electrical Committee of the National Fire Protection Association in the hands of which Committee is now placed the biennial revision of the National Electrical Code.

When a revision takes place the Code is adopted and published as "Regulations of the National Board of Fire Underwriters for Electric Wiring and Apparatus, as Recommended by the National Fire Protection Association."

The Code, with its amplifications for the design and construction of appliances, as mentioned under 6E3a, then becomes the National Standard pertaining to electric wiring and apparatus—and is administered by local Inspection Departments, for which see 6A6.

The Editor wishes to pay especial tribute on behalf of architects to Mr. Alfred Stone who for over ten years so well and so assiduously represented the Institute as its delegate to the National Conference on the Electrical Code. The Reports to conventions year after year will be found printed in the "Proceedings" (1A8f).

(b) The Code is divided into six sections under the designations Class A, B, C, D, E, and F, as listed below. The reader is referred to the Code itself for all detailed descriptions, except the General Suggestions which are here

printed in full for the recommendations which they contain.

Copies of the Code may be obtained from the National Fire Protection Association, the National Board of Fire Underwriters, the Underwriters' Laboratories, the Associated Factory Mutual Fire Insurance Companies (see 6A8 and 6E3e), and from all local underwriters' associations or inspection departments.

6C1 *National Electrical Code—General Suggestions* (quoted from the Code)

"The following general suggestions, as well as the fine print notes in the rules, are simply suggestions and explanations and are in no case to be considered by inspection departments as mandatory."

"In all electric work, conductors, however well insulated, should always be treated as bare to the end that under no conditions, existing or likely to exist, can a ground or short circuit occur, and so that all leakage from conductor to conductor or between conductor and ground may be reduced to the minimum."

"In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors, and securing and attaching of fittings, are specially conducive to security and efficiency, and will be strongly insisted on."

"In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided."

"The use of wire-ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended; and this method of accessible concealed construction is advised for general use."

"Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires, and also for telephone, district messenger, and other signaling system wiring."

6C2 The Other Sections of the Code

CLASS A, *Generators, Motors, Switchboards, etc.*: (Includes electrical equipment of Central Stations, Dynamo, Motor and Storage-Battery Rooms, Transformer Sub-Stations, etc. Rules 1 to 11.): CLASS B, *Outside Work*: (Not including wiring for Light, Power and Heat, Protected by Service Cutout and Switch. For Signaling Systems see Class E.) All Systems and Voltages. (Rules 12 to 15.): CLASS C, *Inside Work*: (Including all work for Light, Power and Heat, Protected by Service Cutout and Switch. For Signaling Systems see Class E.) General Rules, all systems and voltages. (Rules 16 to 19.) Constant-Current Systems. (Rules 20 to 22.) Constant-Potential Systems; General Rules, all voltages. (Rules 23 to 25.) Low-Potential Systems, 550 volts or less. (Rules 26 to 43.) High-Potential Systems, 550 to 3,500 volts. (Rules 44 to 46.) Extra-High-Potential Systems, over 3,500 volts. (Rules 47 to 48.): CLASS D, *Fittings, Materials and Details of Construction*: All systems and voltages. (Rules 49 to 84.): "This section of the Code relating to the design and construction of appliances is but a partial outline of specifications. Underwriters' Laboratories has complete standards for electrical fittings which include the provisions of this Code and in addition specifications for performance under test and in service and further details of design and construction. Copies of these standards will be furnished electrical inspection departments, manufacturing concerns, national electrical associations, societies and institutes, and copies filed with the Bureau of Standards, Department of Commerce, Washington, to which Bureau may be referred questions as to the correctness of the Laboratories' tests": CLASS E, *Miscellaneous*: (Rules 85 to 89.): CLASS F, *Marine Work*.

6D1 The National Electrical Safety Code

(a) After three years of continuous study and investigation and the thorough revision of successive preliminary drafts submitted for discussion and criticism, the Bureau of Standards, in Circular No. 54, Second Edition, November 15, 1916, presents the completed text under this title "National Electrical Safety Code for Examination, Trial, and Constructive Criticism." Copies may be procured

from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 20 cents each, paper bound; 30 cents each in cloth.

In addition to two introductory sections giving definitions of terms and rules for the grounding of apparatus and circuits, the Code consists of four principal parts, as follows:

1. Rules for the installation of machinery, switchboards, and wiring in central stations and substations.
2. Rules for the construction of overhead and underground lines for the transmission and distribution of electrical energy and intelligence.
3. Rules for the installation of electrical apparatus and wiring in factories, residences, and wherever electricity is utilized for light, heat or power.
4. Rules for safeguarding employees when working on or near electrical machines or lines.

This Electrical Safety Code, more particularly Part 3, on Electrical Utilization Equipment, runs parallel with the National Electrical Code (for fire-protection). As it was desirable that there be no conflict between them, and as little overlapping as possible, the Bureau came to an early understanding with the Electrical Committee of the National Fire Protection Association as to the relations between the two codes. The Bureau offered originally to cooperate with the Electrical Committee in framing safety rules to be incorporated in the present electrical code, but at a conference it was found to be the general desire to keep the safety rules and the fire-prevention rules as distinct as possible and have these two parts of a complete electrical code parallel and separate instead of interlaced in such a way that they could not be distinguished. This separation simplifies their preparation, and also their administration, as in some cases administrative bodies concerned with one of the codes will not be concerned with the other.

Part 4 was first published in August, 1914, as Circular No. 49 of the Bureau, and after revision, with the cooperation of the Accident Prevention Committee of the National Electric Light Association, republished in May, 1915, as a second edition of that circular. The rules have been used by a large number of companies during the fifteen months since their second publication, and the present edition has been thoroughly revised in the light of considerable experience in actual use.

The other three parts of the Code were printed as Circular No. 54 of the Bureau, in April, 1915, and have been very thoroughly studied and developed since then. The complete code is now offered for careful study and use in practice, and the Bureau recommends that it be adopted at present only for use on trial. The Code will be revised in a year or so in the light of such experience, and may then be adopted more formally and made mandatory to a greater degree than would be reasonable at present.

Criticism of the rules contained in the Code and sug-

gestions for their improvement, either by way of changes or additions, are invited. Before offering such criticism, however, the statement concerning the plan and scope of the code in the Introduction to Circular No. 54, second edition, should be read, as well as the discussions on the rules.

- (b) As of interest in offering opportunity for the further cooperation of architects in the development of standards pertaining to some of those technical and structural problems with which the successful practice of the profession abounds, the following extracts from a letter to the Editor of the Structural Service Department from the Bureau of Standards are quoted.

"We should be very glad to have the expressed approval of the American Institute of Architects for the idea and general character of the National Electrical Safety Code and the indorsement of the Institute of the Bureau's proposal of giving this Code a thorough field trial in the immediate future with the cooperation of all the agencies concerned.

"In response to your inquiries as to such agencies as may be already utilizing the Safety Code, we may state that the State Commissions of Wisconsin, North Carolina, California, Pennsylvania, West Virginia, and Nevada now use the Safety Code in one form or another. New York City, through its Department of Water Supply, Gas and Electricity, is also making a trial use of the Safety Code in new construction. The Code has also been used as a basis by casualty insurance associations, and in particular by the National Workmen's Compensation Service Bureau operating in a number of states and with headquarters at New York City.

"Among those associations whose committees have for nearly three years been giving active cooperation in the preparation of the Safety Code, may be instanced the American Institute of Electrical Engineers, the National Electric Light Association, the American Electric Railway Association, the American Railways Association, the National Fire-Protection Association, and many others. These associations will, without exception, so we are advised, continue this cooperation and we should greatly appreciate cooperation by a similar committee of The American Institute of Architects, the possibility of which you have suggested. The interest of The American Institute of Architects in the safety of wiring installations is parallel with their interest in the prevention of electrical fires, and they have rendered great service in the past to the Electrical Committee of the National Fire Protection Association in the development of the National Electrical (Fire) Code.

"It has sometimes been proposed that a permanent advisory council drawn from the various national associations cooperating in the development of the National Electrical Safety Code and representative of all interests, including administrators and workmen as well as engineers, would be a desirable method of assuring the general correctness and satisfactoriness of future action in amending the National Electrical Safety Code. We should be glad to have an expression from The American Institute of Architects on the feasibility of such a plan. It is the hope that the continued cooperation of all interested in the Electrical Safety Code will insure its increasing adequacy and reasonableness and bring about its general adoption and use as against the adoption and use in different administrative jurisdictions of electrical safety rules separately arrived at by less extended local study or by the efforts of only a part of the interests concerned. The confusion which would necessarily result from such differing codes is apparent and would mean an unnecessary repetition of the confusion which existed as to electrical fire-prevention rules prior to the formulation and general adoption of the National Electrical (Fire) Code."

Signed, E. R. ROSA, for the Bureau of Standards.

Electricity Within and Around Buildings

6E Apparatus, Appliances and Installations in General

6E1 Information Obtainable

No attempt is here made to list the articles frequently appearing in the periodicals devoted to electrical subjects or in the bulletins, journals, or proceedings of Governmental Departments, professional or technical societies, or educational institutions, the indexes to the publications of all of which, including especially the American Institute of Electrical Engineers, The American Society of Mechanical Engineers and the National Fire Protection Association, should be consulted by those interested, as well also the list of publications of the U. S. Bureau of Standards.

See especially the subdivision 6L for description of the features included under this heading in the Mechanical Equipment of Federal Buildings.

- (a) "Standard Handbook for Electrical Engineers," prepared by a staff of specialists, Frank F. Rowle, Editor-in-chief. 2000 pp.

Fourth edition, revised, rewritten, and reset. The joint production of over 60 leading engineers; written for engineers in practice.

- (b) "American Handbook for Electrical Engineers," Harold Pender, Editor-in-chief, and 26 Associate Editors. 2023 pp., fully illustrated. All phases of electrical engineering and related engineering subjects treated to meet everyday requirements of the practising engineer.
- (c) "Electrical Engineers' Pocket Book," Horatio A. Foster, A.I.E.E., with the collaboration of other engineers and specialists. 1000 pp., illustrated. Useful data for electrical engineers, architects, and electricians.
- (d) "American Electricians' Handbook," Terrell Croft. 711 pp., pocket size, illustrated. Does not go into design and gives only enough theory to explain why certain things should be done in certain ways.

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- (e) "Architects' and Builders' Pocket-Book," F. E. Kidder, pp. 1371-1399; "Electric Work for Buildings," W. H. Timbie. Contains a brief general treatise on electricity, machines, currents, fuses and circuit breakers, describes lighting systems, gives wire calculations, and offers general suggestions for electric work, conduit systems and specifications for interior wiring; illustrated.
- (f) "Mechanical Engineers' Handbook," Lionel S. Marks, pp. 1566-1779; Section on Electrical Engineering by M. C. Beebe and F. A. Kartak, with tables and illustrations including wiring calculations and data on switches and fuses.
- (g) "American Civil Engineers' Pocket Book," Mansfield Merriman, pp. 1310-1340: Section on Electricity.
- (h) "Electrical Cost Data, Estimates and Working Tables," Horatio A. Foster.
- (j) "Switchboards," Wm. Baxter, Jr. 192 pp., illustrated.
- (k) "Cushing's Standard Wiring, 1916," H. C. Cushing, Jr. Based on the latest 1915 National Electric Code's Rules. Has special section devoted to house-wiring, and explains and illustrates the code. Contains tables and formulæ for inside and outside wiring.
- (l) "Wiring of Finished Buildings," Terrell Croft, Consulting Electrical Engineer. 275 pp., illustrated. Combines both commercial and technical aspects. The technical end covers methods of wiring, tools, manipulation, fixtures, and gives examples of successful installations.
- (m) "Electric Wiring, Diagrams and Switchboards," Newton Harrison. 272 pp., illustrated. A practical treatise, included in which is a development of a simple circuit with the position of mains, feeders and branches, their treatment as a part of a wiring plan and their employment in house-wiring.
- (n) "Theatres and Motion Picture Houses," Arthur S. Melloy, Architect. 1916. 125 pp. Includes sections on Electric Wiring, Auditorium Lighting and Stage Lighting.
- (o) "Universal Wiring Computer," Carl Hering. 44 pp., 4 charts. For determining the sizes of wires for incandescent electric lamp leads and for distribution in general without calculation, with some notes on wiring and a set of auxiliary tables.
- (p) "Handbook of Electrical Methods," compiled from the *Electrical World*. 284 pp., illustrated. A collection of useful details that were contributed to the *Electrical World* in four years from the everyday experiences of the workers in the industry. It gives a vast amount of well-arranged information in comparatively small compass.
- (q) "Alternating Current Wiring and Distribution," William L. Emmet. Second edition, 98 pp., illustrated. Contains the principles of alternating currents from the practical point of view, and of their distribution and application to lighting and power.
- (r) "Electric Wiring Specifications," J. H. Montgomery, Professor of Physics and Electrical Engineering in the University of Southern California. 139 pp. A book from which a specification can be readily prepared which will cover all ordinary electrical work.
- (s) "Electric Lighting Specifications," E. A. Merrill. 213 pp. For architects and engineers.
- (t) "The Wiring Handbook," with 32 complete labor-saving tables and digest of underwriters' rules, by Cecil P. Poole. 85 pp., illustrated.
- (u) "Building Estimators' Reference Book," Frank R. Walker, pp. 3300, 3301: Section on Electric-Wiring.
- (v) "How to Check Electricity Bills," S. W. Borden. 55 pp., illustrated.
- (w) "Mechanical Engineers' Pocket Book," William Kent, pp. 1396-1467, also pp. 713, 714 and 1420-1425 for electrical heaters, heating, and furnaces.
- (x) See "Electrical Data," August, 1916. Published by Underwriters' Laboratories. 22 pp., illustrated. Contains: Announcement of Label Service for Cartridge-inclosed Fuses and Snap Switches; A Retrospect; Causes and Losses in Fires Due to Electricity; Rats and Lead-covered Cable; Fires and Accidents Due to Electrical Causes.
- (y) In the "I.C.S. Electrical Engineers' Handbook" will be found much valuable information presented in a form useful to architects and engineers, comprising tables and sections on Electricity and Magnetism, Dynamos and Motors, Electric Lighting, Interior Wiring Power Transmission, and Operation and Maintenance of Electrical Apparatus. 414 pp.
- (z) The above handbook is independent of 23 volumes on Electrical Engineering and allied subjects in the extensive International Library of Technology, each of which treats the subject exhaustively.
- (aa) Read Reports of Committees printed in Proceedings of the American Society for Testing Materials (1A4a), 1916:
 - 1. Committee B 1 on Copper Wire, p. 177.
 - 2. Committee D 11 on Rubber Products.
- (bb) Refer to the various publications mentioned under the Societies Associations and allied Agencies 6A1 to 6A9.
- (cc) For information on electrical apparatus, installations and appliances in general, with notes, explanations and descriptions pertaining to the utilization of electrical energy in buildings and

with references in many cases to the National Electrical Code, latest Underwriters' requirements, and other controlling factors. See pp. 148-158 of the General Electric Company, including Sprague Works, in the Industrial Section. This includes generators, switchboards, motors and other apparatus, conduits, wiring devices and other subjects listed in the special G-E Index on p. 148.

- (dd) For information concerning subjects under this heading, see the Industrial Section, p. 173. National Metal Moulding Co., "How to Write Conduit Specifications."

6E2 Practice Recommended or Suggested by

- (a) U. S. Bureau of Standards:
 - 1. See description of National Electrical Safety Code (6D11a).
- (b) National Fire Protection Association (3A3):
 - 1. See the "General Suggestions" which preface the National Electrical Code and which are printed in full under 6C1. Particular attention is called to the last two paragraphs recommending the general use of wire-ways for rendering concealed wiring permanently accessible (conduit systems) and urging architects when drawing plans and specifications to make provision for the channeling and pocketing of buildings for these and all other possible arteries for the utilization of electrical energy.
 - 2. See "Field Practice," Inspection Manual of the N.F.P.A.; pp. 23, 31, 48, 77, and 75-77 for notes on the installation, care and maintenance of electric heating devices, irons, motors and power equipment, and other sections for explanations of the rules and requirements of various inspection departments of label service and of matters in general pertaining to good practice.
- (c) National Board of Fire Underwriters (3A4):
 - 1. From the "Building Code—1915" (3A4d1) the following is quoted in full from Section 261: "Electrical Installations—All electrical wiring, apparatus, or appliances for furnishing light, heat, or power shall be in accordance with the 'National Electrical Code,' and no installation of electrical equipment shall be made, except in conformity thereto."
 - 2. In "Dwelling Houses" (3A4d3) the section relating to Electrical Installations is of exactly the same purport.
- (d) American Society for Testing Material (1A4):
 - 1. Tentative Standard Specifications for Insulated Wire and Cable, 30 per cent Hevea Rubber; Serial Designation D 27-16 T.
- (e) Mechanical Equipment of Federal Buildings.
 - 1. See the description of publication with this title given under 6L.

6E3 Standards Adopted and Progress Reported

- (a) The National Electrical Code:

The Code (6C) comprehends the allowable approved methods for the manufacture of electrical apparatus and for the installation of conduits, wiring, switches, fixtures and devices carrying or consuming electricity in connection with buildings.

Where the Code is printed for the information of architects and building constructors, sections relating essentially to methods of manufacture are usually omitted.

It is presumed that such sections are complied with by reputable manufacturers and have become a precedent to their products being labeled by the Underwriters' Laboratories, which label is the architect's and user's evidence of compliance with the requirements of the Code.

It is of interest to note that the building codes of many of the larger cities make no mention of compliance with the Code or offer any other requirements which must be complied with in the wiring of buildings for electricity. There are few cities or towns where the electric light and power company will supply service to a building until a certificate of inspection of the wiring is secured from the local board of Underwriters or from the municipal electrical inspection department. Where there is a municipal inspection department, it is generally a violation of the city ordinance for the lighting company to provide service until such certificate has been obtained; in other cases there is an agreement with the lighting company not to connect to the building until the electrical work therein has been inspected and approved. It is also well known to the framers of codes that the furnishing of such a certificate is a requisite before fire insurance may be placed on any building, and that without such insurance mortgages cannot be negotiated or other financing of building construction be consummated. It would seem then that this system is practical, and it is taken for granted that it will be understood without the frank acknowledgement which one might expect to find in building codes of the procedure to be followed.

Specifications will invariably provide that the local requirements shall be met, for the same will be based upon the National Electrical Code, with such amplifications and variations as climatic and other conditions warrant.

- (b) Standardization Rules of the American Institute of Electrical Engineers (see 6A1d):

In these particular effort has been directed toward defining in engineering terms the rating of electrical machinery and the requirements connoted thereby.

- (c) International Standardization:

"It becomes impossible to carry standardization beyond a very elementary stage in any one country, without influencing the procedure in other countries. Coöperative relations have been entered into at different times between the A.I.E.E. Standards Committee and corresponding committees in other countries, to considerable mutual advantage, but especially through the influence of the International Electrotechnical Commission, an international body engaged in international electrical engineering standardization."

- (d) "List of Inspected Electrical Appliances:"

(This list and a "List of Manufacturers of Inspected Mechanical Appliances;" also "List of appliances Inspected for accident Hazard" are published by Underwriters' Laboratories. Both lists are revised semi-annually.) See 1B2a, 3A6.

"Products labeled or listed as mentioned above are not necessarily uniform in quality or merit, the labeling and listing indicating only compliance with Underwriters' requirements."

- (e) "Electric Light and Power Equipments—Rules:

"Approved Electrical Fittings" (subject to semi-annual revision). (These two publications are issued by the Inspection Department of the Associated Factory Mutual Fire Insurance Companies.) See 3A7.

"The 'List of Approved Electrical Fittings' is designed to enable mill managers and electrical contractors to quickly learn where thoroughly reliable fittings can be obtained. This pamphlet forms a supplement to 'Rules for Installing Electric Light and Power Equipments,' which should be carefully followed in all electrical construction work."

- (f) "Universal Safety Standards:" A reference book of Rules, Drawings, Tables, Formulae, Data and Suggestions for use of Architects, Engineers, Superintendents, Foremen, Inspectors, Mechanics and Students, by Carl M. Hansen, M.E., Consulting Safety Engineer, Member American Society Mechanical Engineers. Compiled under the direction of and approved by the Workmen's Compensation Service Bureau, New York City.

- (g) See also "Electrical Edition" of same.

- (f) and (g) contain diagrams and descriptions of guards for motors, switchboards, starting panels, controllers, fuse-boxes, and other safety devices.

- (h) The American Society for Testing Materials has adopted the following:

1. Standard specifications for Hard-Drawn Copper Wire, Serial Designation B 1-15.
2. Standard Specifications for Medium Hard-Drawn Copper Wire, Serial Designation B 2-15.
3. Standard Specifications for Soft or Annealed Copper Wire Serial Designation B 3-15.
4. And others relating to cables, trolley wires, and specialized products.

- (j) U. S. Bureau of Standards:

1. See Circular No. 31, "Copper Wire Tables," referred to under 6E3b.

2. The Bureau is coöperating with a number of testing laboratories identified with the American Society for Testing Materials in investigating the merits of an accelerated heat-test as applied to rubber insulation on wire. The object of the work is to determine the relative effect of dry heat 160° F., as compared with the effect of natural aging under uniform atmospheric conditions. The relative effect of dry heat, as compared with natural aging, has been studied in the case of fifty-five rubber compounds.

3. Some of these results appear in third edition Bureau of Standards Circular No. 38, "Testing of Mechanical Rubber Goods."

- (k) Office of the Quartermaster-General U. S. Army:

1. See General Electrical Specifications, No. 6, described under 6O.

6E4 Standard Symbols and Charts (See, also, 7E1j and 7M2)

- (a) See Standard Symbols for Wiring Plans, as adopted by the National Electrical Contractors' Association of the U. S. and the American Institute of Architects, mentioned under 6A4a. In addition to the copies on cardboard, which may be had as there mentioned, these Symbols may be seen illustrated and explained in:

1. "Kidder's Pocket Book—1916," pp. 1398-1399.
2. "Sweet's Architectural Catalogue—1917," p. 1423.

3. "Portfolio of the Architectural Service Corporation," Service Sheet No. 1, January, 1916.

- (b) Standard Conduit Charts, showing standard sizes of conduits for the installation of wires and cables, adopted and recommended by the National Electrical Contractors' Association of the U. S. and required by the National Electrical Code, may be obtained, as mentioned under 6B2b. (See 6G14.)

- (c) Standard Symbols, also illustrated in U. S. Army Specifications, 6O.

6F Electric Elevators and Dumbwaiters. (See, also, 11B10k and l)

Complete descriptions will be found in some, and a very considerable amount of valuable data in others, of the publications mentioned below:

See especially the Chapter on "Elevators" from "Mechanical Equipment of Federal Buildings" described under 6L.

1. "Standard Handbook for Electrical Engineers," Frank F. Fowler: Section on "Electric Elevators," by D. L. Lindquist, Chief Engineer Otis Elevator Co., and Asso. A.I.E.E.
2. "Mechanical Engineers' Handbook," Lionel S. Marks: Section 9 treats of "Hoisting and Conveying," by C. Kemble Baldwin, pp. 1006-1187.
3. "American Handbook for Electrical Engineers," Harold Pender: Section on "Electric Elevators."
4. "Architects' & Builders' Pocket Book," F. E. Kidder: Section on "Elevator-Service in Buildings," pp. 1579-1597, contains information on electric elevators and gives valuable data for calculating the number of elevators required, determining sizes, etc.—similar to that mentioned under J11h.
5. "Electrical Engineers' Pocket Book," Horatio A. Foster: Section on "Electric Elevators."
6. "Mechanical Engineers' Pocket Book," Wm. Kent: Section on "Hoisting and Conveying," pp. 1181-1218.

7. "Building Estimators' Reference Book," Frank R. Walker: Chapter XXII on "Miscellaneous Building Specialities," pp. 2900-2906, gives information on Cost of Electric Passenger Elevators, Electric Freight Elevators, Cost of Cars and Dumbwaiters.

8. "Elevator Shaft Construction: Practical Suggestions for the Installation of Elevators in Buildings," H. R. Cullmer and A. Bauer.

9. "Universal Safety Standards" (described under 6E3f) shows safety devices, controls, guards, hatchways and entrances, automatic trap-doors and gates, platforms and guards for sheaves and for safe installations in general.

10. The codes of cities or ordinances regulating elevator construction will also afford specification requirements. Valuable suggestions will be found in catalogues and other literature of manufacturers.

11. For specific information pertaining to the installation of electric elevators, see pages in the Industrial Section as follows:

- (a) Otis Elevator Co., pp. 170, 171.
- (b) A. B. See Electric Elevator Co., pp. 160, 161.

12. For information relating to dumbwaiters (hand-power), see Industrial Section, pp. 220, 221, Sedgwick Machine Works.

13. Addenda.—See "Uniform Regulations for the Construction and Installation of Passenger and Freight Elevators," adopted Oct. 12, 1917, as mentioned under 12L22.

6G Telephones, Signaling Systems, Clocks and Bells

Attention is again directed to the necessity of providing in all buildings such chases, channels, pipe-ducts, or runways as will adequately meet all needs for installing arteries of service, not only for present requirements, but allowing also for reasonable future needs and the possibility of installations not now thought of.

1. The two following paragraphs are again quoted from the National Electrical Code:

- (a) "The use of wire-ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended; and this method of accessible concealed construction is advised for general use."

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- (b) "Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires, and also for telephone, district messenger, and other signaling system wiring."
2. "Telephone Construction, Installation, Wiring, Operating and Maintenance," W. H. Radcliffe and H. C. Cushing, Jr. 223 pp., illustrated. Intended for electricians, wiremen, engineers, architects, contractors and others interested in the installation of telephone exchanges in accordance with standard practice.
3. "Architects' & Builders' Pocket Book," F. E. Kidder: Section on "Interphones and Automatic Telephones for Intercommunicating Service," pp. 1627-1628.
4. "American Handbook for Electrical Engineers," Harold Pender: Section on "Telephone Instruments and Circuits," pp. 1530-1550.
5. "Standard Handbook for Electrical Engineers," Frank F. Fowler: Section on "Telephony, Telegraphy, and Radio-telegraphy."
6. "Electrical Engineers' Pocket Book," Horatio A. Foster: Section on "Telephony."
7. "American Telephone Practice," Kempster B. Miller. 904 pp., illustrated.
8. "American Civil Engineers' Pocket Book," Mansfield Merriman: Section 14, Article 19, p. 1339. Information on open-circuit batteries for use on intermittent service, such as call bells and short telephone lines.
9. "Fire Prevention and Fire Protection," J. K. Freitag: Chapter XXXI, "Automatic Fire Alarms, and Sprinkler Alarm and Supervisory Systems," pp. 908-921; also Chapter XXXIII, "Watchmen, Watch-Clocks and Manuals," pp. 944-958.
10. "Crosby-Fiske Handbook of Fire Protection," Fifth Edition (Sixth Edition now in preparation): Section on "Signaling Systems and Watchman Service," pp. 250-269.
11. "Field Practice," Inspection Manual of the N.F.P.A. Information on signaling systems, pp. 179-182.
12. "I.C.S. Telephone and Telegraph Engineers' Handbook." Contains useful tables, and sections on Telephone and Telegraph Systems, Location of Faults, Electricity, Magnetism, Electrical Measurements, and Batteries. 398 pp.
13. See the "I.C.S. Electrical Engineers' Handbook" (6E1y) for information on signal-bell circuits, pp. 369-371.
14. Along the lines of the recommendations contained under 6G1a and b, above referred to, it should be noted that the N.E.C. does not prescribe the sizes for conduits for signal systems and that the wires permitted by the telephone companies of various cities differ as to thickness of insulation. The Chart (described under 6E4b) therefore represents wires with both light and heavy insulation and shows conduit sizes accordingly.
15. See "Mechanical Equipment of Federal Buildings" 6L1f.
16. See General Electrical Specifications No. 6, U. S. Army, described under 6O; specifies and illustrates bell systems, batteries, bells, push-buttons, annunciators, buzzers, transformers, speaking-tubes, etc.
17. Some telephone companies insert notices similar to the following in their directories: "Adequate facilities for handling telephone wires and cables in new buildings will mean the most satisfactory telephone service for the tenants. Satisfied tenants are an asset to the owner of a building. The Telephone Company asks the cooperation of the architects. When designing new buildings, call the Plant Engineer."
18. The New York Telephone Company states that of the two ways to wire an apartment house—conduit system or wires in a molding—the conduit layout is now generally preferred.
19. Standard of Telephone Service:
Preliminary studies have been undertaken to ascertain to what extent the different grades of telephone service required under different conditions can be adequately described in series of standard service specifications. Detailed studies under actual operating conditions, and under the manifold variations encountered in different localities, are necessary before it will be possible for the Bureau of Standards to suggest suitable service standards for telephony similar to those already proposed for gas and electric light and power supply. Such detailed cooperative studies in this and other lines are necessary before public utility commissions can regulate telephone utilities with full justice to all interests concerned. From Report of Bureau of Standards, 1916.

6H Illumination, Lighting Fixtures and Lamps (See, also, 7M, 11B13 and 12F5)

Most of the publications which follow treat of illumination by gas as well as electricity, and cross-reference to same will be made under the next Serial Number (7) when those which treat especially of gas will be separately referred to. In that number also will appear a description of the Illuminating Engineering Society.

6H1 Information Obtainable

- (a) "The Art of Illumination," Louis Bell, Ph.D. 353 pp., illustrated. Dr. Bell's treatise was the pioneer book on illumination. The new edition, entirely rewritten, is designed primarily for the use of illuminating engineers.
- (b) "Radiation, Light and Illumination," Charles P. Steinmetz, Ph.D. 305 pp., illustrated. It covers illuminating engineering fully, and will appeal strongly to the illuminating engineer and to the architect as well.
- (c) "Factory Lighting," Clarence E. Clewell, Assistant Professor of Electrical Engineering, University of Pennsylvania; formerly Lighting Expert, Westinghouse Co. 160 pp., illustrated. Tells in a simple way how to obtain good lighting by analyzing actual installations, and gives illustrations to show good and bad lighting in shops, drafting-rooms, offices, power-houses, etc.
- (d) "Illumination and Photometry," William E. Wickenden, Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology. 195 pp., fully illustrated. An investigation of the scientific principles of illumination. Subject treated in a condensed way, but always with emphasis upon the principles.
- (e) "Practical Illumination," J. R. Cravath and V. R. Lansing. 356 pp., illustrated. Gives suggestions and specific data showing the application of the broad general principles underlying the design of artificial illumination for everyday use in all kinds of buildings.
- (f) "Architects' & Builders' Pocket Book," F. E. Kidder: Section on "Lighting and Illumination of Buildings," by W. H. Timbie, pp. 1351-1370.
- (g) "Mechanical Engineers' Handbook," Lionel S. Marks: Section 11 contains a chapter by Louis Bell on "Illumination," treats of Computation of Illumination, Practical Sources of Light, and Methods of Lighting; pp. 1366-1381.
- (h) "American Civil Engineers' Pocket Book," Mansfield Merriman: Section 14, Article 18, pp. 1335-1338, gives information on "Electric Lighting and Illumination."
- (j) "Mechanical Engineers' Pocket Book," Wm. Kent: Section on "Illumination," pp. 1,468-1,477.
- (k) "Standard Handbook for Electrical Engineers," Frank F. Fowler: Section on "Illumination."
- (l) "American Handbook for Electrical Engineers," Harold Pender: Section on "Illumination," pp. 756-763.
- (m) "American Electrician's Handbook," Terrell Croft: Illustrated section on "Illumination."
- (n) "Crosby-Fiske Handbook of Fire Protection," (sixth edition now in preparation). Information on "Lighting by Electricity," in fifth edition, pp. 120-122.
- (o) See Section on "Illumination" in "Electric Light Wiring," C. E. Knox. 225 pp., illustrated.
- (p) See "Electric Lighting Specifications," E. A. Merrill. 213 pp. For architects and engineers.
- (q) See "Theatres and Motion Picture Houses," Arthur S. Melloy, Architect. 1916. 125 pp. Includes sections on "Auditorium Lighting" and "Stage Lighting."
- (r) "Color and Its Applications," by M. Luckeish.
- (s) "Light and Shade and Its Applications," M. Luckeish.
- (t) Consult the list of publications issued by the U. S. Bureau of Standards for Bulletins bearing on this subject.
- (u) See the pamphlet entitled "Light—Its Use and Misuse," published by the Illuminating Engineering Society (Serial No. 7).
- (v) See also the periodical of the I.E.S. called the "Transactions," in which are printed papers dealing with all phases of the art and science of illumination.
- (w) See the "I.C.S. Electrical Engineers' Handbook" (6E1y) for information on Illumination and Lamps.
- (x) For general information on illumination with reference to exterior and interior lighting units of the General Electric Company and of its Ivanhoe-Regent and Edison Lamp Works, and to Mazda lamps, see pp. 148-158 of the G-E Company, in Industrial Section. Also the G-E Index.
- (y) For Types of Lighting, Terms Used, Measurement of Lighting and Method of Determining Quantity of Light with a Table of the Average Practice in this Regard, see "Electrical Information and Data" furnished by the Society for Electrical Development, Inc., and printed in "Sweet's Architectural Catalogue," 1916, pp. 1316-1318.
- (z) See "Illustrations of Electrical Fixtures and Equipment," pp. 93-133 in "General Electrical Specifications No 6., Prepared in the Office of the Quartermasters-General, U. S. Army, March, 1915" (6O).

6H2 Practice Recommended and Standards Adopted

- (a) Refer to appropriate sections of National Electrical Code (N.F.P.A.) and National Electrical Safety Code (U. S. Bureau of Standards).
- (b) See "Field Practice" (N.F.P.A.), 3A3d1, sections on "Lighting Hazards—Electricity," pp. 21-23 and 130.
- (c) See "Code of Lighting: Factories, Mills and other Work Places," prepared by committees of the Illuminating Engineering Society and issued under the direction of the Society (to be described in Serial No. 7). Copyright 1915. 45 pp., with half-tone illustrations, plans, sections and other diagrams. Treats of daylight requirements as well as of artificial illumination. "While the code is intended as an aid to industrial commissions and other similar bodies in those states and municipalities which shall actively take up the questions of legislation as related to factory and mill lighting, it is intended in equal measure for the industries themselves as a practical working guide in individual efforts to improve lighting conditions. The language of the code has not been drafted according to legal phraseology but is simple and pointed throughout, thus being readily available for transforming into legal orders, and at the same time as a working guide in practical design and installation work."
- (d) See reports of various committees of the Illuminating Engineering Society.
- (e) Consult, in Associated Engineering Societies' Library, publications of the National Electric Light Association, such as those of the Lighting Sales Bureau, Reports of Subcommittee on Industrial

- and Yard Lighting, on residential lighting, and on other lighting problems. Illustrated with diagrams of buildings and plates showing installations, lighting fixtures and other essentials.
- (f) See "List of Inspected Electrical Appliances" (6E3d).
 - (g) See "Approved Electrical Fittings" (6E3e).
 - (h) For "Standard Symbols" indicating number and kind of lights to wiring outlets and methods of control, see description under 6E4.
 - (j) For valuable data and suggestions on illumination and the wiring to accomplish same, see "Mechanical Equipment of Federal Buildings" as described under 6L1f and 6L1g.
 - (k) As a Standard which may be followed, see 6Hiz.

6H3 Life Testing of Incandescent Lamps

The lamps purchased by the Federal Government, amounting to about 1,250,000 annually, are inspected and tested by the Bureau of Standards. The specifications under which these lamps are tested are published by the Bureau and are recognized as standard by the manufacturers as well as by the Government. They are used also by many other purchasers of lamps.

The lamps are first inspected for mechanical and physical defects, this being done at the factory by Bureau inspectors. Representative samples are selected and sent to the Bureau, where they are burned on life test at a specified efficiency, at which they must give a certain number of hours' life, depending upon the kind of lamp. From 3,000 to 5,000 lamps are thus burned on test each year.

Scientific Paper No. 265 gives a complete description of the special apparatus and of the methods used in these inspections and tests. From Report of the Bureau of Standards, 1916.

6J Heating, Cooking and Other Appliances and Devices

1. These various appliances and devices pertaining to the comfort and convenience of occupants of hotels, apartment houses, office buildings, residences, and other structures are treated in but very few of the Electrical handbooks and other such publications. Some will occasionally be found by looking in the index of publications referred to, but so rapidly is development taking place in their manufacture and utilization that the chief source of informa-

tion to be had concerning them is through catalogues and other literature of the manufacturers themselves.

- (a) Some notes and suggestions on various devices will be found in Useful Information for architects, contractors and engineers referred to under 6A2 and elsewhere.
- (b) For a list of many such devices of the latest type and for publications pertaining to them see the General Electric Company's presentation in the Industrial Section, pp. 148-158.

6K Vacuum Cleaners

1. This important modern development in building sanitation will also not be found treated in many of the handbooks elsewhere listed though the operating and controlling features of so many of these systems, whether stationary or portable, are of interest electrically. For this reason the subject is treated in this issue, although vacuum systems will be again mentioned in a later Serial Number.

Included in standard handbooks, the subject has been found treated in:

- (a) Kidder's "Architects' & Builders' Pocket Book," 1916. See "Vacuum Cleaning," pp. 1628, 1629.
- (b) For a complete treatise on the whole subject, including a highly interesting historical review of the development of the Vacuum Cleaner, see "Vacuum Cleaner Systems," by M. S. Cooley, Mechanical Engineer in office of the Supervising

Architect, Treasury Department. Copyright 1913 by Heating and Ventilating Magazine Company of New York. 232 pp., completely illustrated.

This states the requirements of an ideal system and gives descriptions and diagrams of all mechanical and electrical parts of various systems, including the pipe and fittings, controlling appliances and tools.

It gives data on the selection of various types, methods of testing and Specifications for five classes of plants.

It also describes portable vacuum cleaners, including those for attachment to lighting systems.

- (c) See Chapter on "Vacuum Cleaning Systems" described under 6L1f.
- (d) For detailed drawings of the mechanism and data pertaining to various vacuum-cleaner systems, see the catalogues and other literature of the respective manufacturers.

6L Mechanical Equipment of Federal Buildings

1. A subdivision is given to this subject in order to mention and briefly describe a publication with which all architects should be familiar, in connection with the mechanical equipment in buildings, other than residences, whether or not the same are installed in coöperation with consulting engineers.

This refers to "Mechanical Equipment of Federal Buildings under the control of the Treasury Department," by Nelson S. Thompson, Chief Mechanical and Electrical Engineer, Office Supervising Architect, Treasury Department, Washington, D. C.

The subjects treated are as follows:

- (a) Chapter I. Heating and Ventilation.
- (b) Chapter II. Commercial Practice in Regard to Heating Factory and Other Buildings.
- (c) Chapter III. Commercial Practice in Regard to Heating by Forced Circulation of Hot Water from a Central Station. (These will be described in the issue of the Journal devoted to Heating and Ventilation).
- (d) Chapter IV. Plumbing, Drainage and Water-Supply. (Will be described in Plumbing issue.)

- (e) Chapter V. Gas Piping.

(Will be described in next issue.)

- (f) Chapter VI. Conduit and Wiring Systems.

This gives the standard arrangement for electric installations in Federal buildings, including underground service, switchboards, distribution tablets, table of conduit sizes for conductors, and of lead-encased cable in unlined metallic conduit, describes outlets and standard wiring for lighting, gives wiring formulae and tables, gives data on illumination with tables of effective lumens for different lamps and reflectors, and estimating data on electrical appliances.

It also includes conduit systems for time-clocks and other special purposes, also town clocks, fire alarm and watchman's time-detector systems, vault-protection systems, telephone and call-bell conduits, and conduits for signal systems.

- (g) Chapter VII. Lighting Fixtures.

This gives "Basic Data in Connection with Design and Installation of Lighting Fixtures," and data for estimating the cost of same. It also includes a "typical lighting fixture speci-

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- fication prepared by the office" which covers various types of fixtures, glassware, reflectors, metals and finish, switches, and gives a schedule of fixture and notes on inspection and tests.
- (h) Chapter VIII. Elevators.

This gives data of the utmost importance to architects, especially in the preliminary study necessary to reach a decision upon the number, type and speed of elevators for all kinds of structures.

With the aid of individual experience and judgment, a close approximation of the number of elevators and of the size of each which should be installed in a given building may be based on the facts in regard to elevator service in this chapter which are stated by Mr. R. P. Bolton, consulting engineer, of New York, in his treatise entitled "Elevator Service."

It also gives data to determine the loads to be carried and space requirements, and states recommendations as to various forms of equipment, concluding with a "Specification for the standard tandem worm geared electric passenger elevator with direct current motor and full magnet control such as is installed by the office of the supervising architect," and a supplementary specification for "Alternating Current Elevators," following which is "Instructions Relative to the Inspection and Test of New Elevators."

- (j) Chapter IX. Small Power Plants.

This is prepared with special reference to installations in Federal buildings under control of the Treasury Department and states all items which require consideration in determining whether the mechanical equipment should include a power plant for the generation of electric current for light and power.

It discusses types of engines and electric generators, gives tables and includes "A specification for Engines and Generators as prepared in the office of the Supervising Architect."

- (k) Chapter X. Motors and Controlling Apparatus.

Discusses direct and alternating current motors and gives various recommendations.

- (l) Chapter XI. Vacuum Cleaning Systems.

This contains data on stationary systems of both the so-called high-vacuum and low-vacuum types and gives tables for determining the sizes of plants and recommendations for installation. It also includes a complete "Specification such as is used by the office of the Supervising Architect for a Four-sweeper

Plant," included in which is a description of the electric motor and its automatic control.

- (m) Chapter XII. Operating Data.

This gives calculations of cost of operating mechanical equipments with sample reports of those made in certain Federal buildings and includes a discussion of the isolated plant versus the central station as regards heat as well as electric current.

Appendix.

- (n) General Instructions, issued to draftsmen by the Chief Mechanical and Electrical Engineer, Office Supervising Architect.

This could well be read by all practising architects as it contains eleven pages of valuable suggestions which could be followed in the case of any building, taking up as it does the procedure followed in an office from the inception of a building project to its conclusion. It not only treats of surveys and data to be obtained concerning the site, its surroundings and public utilities, but contains many calculations for determining quantities cost and space requirements with respect to all features of mechanical equipment and building construction affected. It contains also recommendations as to procedure and gives departmental requirements about which it is well to be informed.

- (o) Suggestions to Superintendents.

These are a natural complement of and extensions to the General Instructions to Draftsmen just referred to.

- (p) Miscellaneous Data.

Consist of tables such as Capacity of Cylindrical Tanks and many others of much usefulness.

6L2

In this subdivision it is also desired to call attention to the Journal of the Society of Constructors of Federal Buildings (2A4a). In various numbers of this publication will be found contributions of interest to architects, engineers, and constructors on electrical installations and other matters pertaining to the mechanical equipment as well as the construction of buildings.

6M Lightning Protection (For data, see April Journal, Serial No. 4G)

6N Electrolysis (See, also, Corrosion and Treatments of Metals, 11B2, 11B3 and 4; also 12C)

References to this subject will be found in many of the publications elsewhere referred to; also under "Experiment and Practice" in Trautwine's Civil Engineers' Pocket Book, pp. 1168, 1182. See, also, the following publications of the U. S. Bureau of Standards:

Technologic Paper No. 28, "Methods of Making Electrolysis Surveys;" Technologic Paper No. 54, "A Report on Conditions in Springfield, Ohio, with Insulated Feeder System Installed;" Technologic Paper No. 55, "A Preliminary Report on Electrolysis Mitigation in Elyria, Ohio;" Technologic Paper No. 62, "Modern Practice in the Construction and Maintenance of Rail Joints and Bonds in Electric Railways;" Technologic Paper No. 63, "Leakage of Current from Railways;" and Technologic Paper No. 75, "Some Instances of Track Leakage."

The following extracts from the Report of the Bureau of Standards, 1916, will be found of interest.

"When considering the enormous value of the pipe and cable properties buried in the streets of cities and forming in many cases transmission networks between cities throughout the country, and when considering further that there are very few water, gas, or lead cable systems which are not more or less subject at some points to electrolytic damage from stray currents, it is possible to better form a judgment of the practical importance of this subject which still does not receive in many quarters the attention that its importance deserves.

The water- and gas-pipe systems of this country alone have an aggregate value at the present time of approximately \$1,500,000,000, and in addition to this there is a vast extent of underground lead-cable systems belonging to telephone and electric power companies and to municipalities, a considerable part of which may be more or less subject to electrolytic damage. There are also possibilities of trouble in the case of bridge structures, portions of steel frame buildings, and piers, which are occasionally exposed to damage from this source. While it is impossible at present to determine with any accuracy the extent of the damage to pipe systems by electrolysis, nevertheless, the most conservative estimates place it at many millions of dollars annually.

The Bureau has been studying the electrolysis question for the past six years and has done a large amount of work in connection with it. The first problem investigated was that concerning the effects of electrolysis in reinforced concrete, after which special attention was given to electrolysis of underground pipes. This has included laboratory investigations concerning the effects of electric current on concrete and on metal pipes, tests of pipe-coverings, the corrosion of metals in the soil, methods of measuring soil resistance, and various other experimental phases of the work; methods of electrolysis mitigation that have been used or proposed; field studies in actual practice with the application of remedies; and a determination of the cost and results obtained.

6O Electrical Specifications, U. S. Army

The Office of the Quartermaster-General U. S. Army has prepared and issued, under date of March, 1915, "General Electrical Specifications No. 6 for Furnishing and Installing Electric Light Wiring, Electric Fixtures, and Electric Bell Systems in Buildings and the Construction of Interior Lighting and Distributing Systems, all Pertaining to the Quartermaster Corps, U. S. Army." These may be obtained from Superintendent of Documents' Government Printing Office, Washington, D. C. The whole consists of 139 pages, and various Sections relate to matters covered by the title and to the construction of exterior lighting and distributing systems, complete in every detail. The various sections are referred to in this Serial Number under their appropriate subdivisions, including the Standard Symbols and the Fixtures and other illustrations.

It is to be noted that it is stated "Unless otherwise specified all wires in new buildings shall be run in what is known as concealed stiff steel conduit work, all conduit being run concealed except in unfinished parts of the buildings . . . Unless otherwise specified all wiring in old buildings shall be done with flexible steel armored conductors, run concealed except in unfinished parts of buildings" and also, "all work shall be done in the most thorough and approved manner, in strict accordance with these specifications, the plans and schedules attached to specifications for buildings, and in accordance with the rules of the latest edition of the National Electrical Code."

Serial No. 7

GAS ISSUE

CONTENTS

This, the second of the Mechanical Equipment group of four issues, is devoted to the utilization of gases and vapors in and around buildings. The various gas interests of the country and architects and owners as well are, in this connection, greatly concerned with the proper installation of piping to make available the manifold uses to which gas may be put. These are potential as well as actual, and emphasis has been laid in this presentation on: first, the feature of supplying buildings with gas for all purposes;

and, second, the proper piping to secure adequate service throughout.

In the existing dearth of consulting engineers on gas equipment for buildings, the national associations mentioned and the local organizations, of which there are many, may be relied upon to supplement the information given and to coöperate in carrying forward the various recommendations described.

JULY, 1917

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| 7A2 American Gas Institute. | 7H Gas Appliances in General. |
| 7A3 National Commercial Gas Association. | 7J Space Heating by Gas. |
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7A1 Gas Societies and Associations

7A2 *American Gas Institute.*

Secretary: George G. Ramsdell, 29 W. 39th St., New York City.

(See also "Other Gas Organizations" (7B) for those affiliated.)

Publications:

- (a) "Proceedings," published annually.
- (b) Certain committee Reports of an exhaustive nature are published separately, especially those relating to standardization of methods or materials.
- (c) Of this class the "Gas Chemists' Handbook" is a notable example.
- (d) "Standard Specifications for Cast Iron Pipe and Special Castings." These embrace the results of work which covered a great many years and was first started by the Society of Gas Lighting about 1890. The American Gas Light Association reported a new standard in 1906, and the American Gas Institute in 1911 and 1913 adopted these standards. (See 7E3f.)
- (e) Monthly bulletin entitled "Gas Institute News." Contains: an educational article in each issue, which articles when completed will form a textbook on the manufacture and distribution of both coal and water gas.
The "Proceedings" and "Gas Institute News" are furnished free to members.
- (f) "Bulletin of Abstracts." A classified record of the best technical articles appearing in the domestic and foreign journals, arranged for filing in card-index form.

- (g) Report of the Committee on Refractory Materials.
- (h) "Bibliography of Refractory Materials."
- (j) "The Installation of Cast Iron Street Mains."
- (k) Report of the Committee on Supplying Large Buildings with Gas or Piping Large Buildings. Reports of 1914-16.
- (l) Committee Reports on Housepiping. 1915-16. (7E2, 3 and 4.)
- (m) "Proper Specifications for and Inspection of Interior Piping," Turner (7E1b and 7E3c).
- (n) Reports of Committee on Utilization of Gas Fuel Appliances.

The Institute is the national technical gas association, its membership embracing the prominent gas engineers and managers of the country. The technical work is handled through committees which also secure papers and submit the results of their work in the form of reports for presentation at the annual convention. These are published later in the "Proceedings" each year.

In addition to its technical activities, the Institute has also taken a leading part in matters of importance pertaining to the relations of the gas industry to the public, working through its committees in coöperation with various public service commissions and regulatory bodies.

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7A3 National Commercial Gas Association

Secretary: Louis Stotz, 61 Broadway, New York City.

Publications:

- (a) "Proceedings" of annual meetings.
- (b) "Monthly Bulletin." Contains papers, discussions, and general information. One department is devoted to "Gas Literature for the Busy Man," and gives a list of journals which will be found valuable if kept for reference. Subscription, 50 cents per year. Furnished free to members.
- (c) "Industrial Fuel Reference Books." A series of pamphlets issued during 1916 and 1917, dealing with the "Application of Gas" to various needs in the industries and within buildings. Prices, from 20 cents to 50 cents each.
- (d) "Utilization of Gas Appliances." A series of eleven pamphlets, covering in a most thorough manner the development, construction, and installation of all domestic fuel appliances. Price of complete set \$2.50.
There is available only a limited number of copies of these books, which are especially valuable as reference works.
- (e) Pamphlets entitled "Lessons," which accompany the "Practical Gas Education Course" elsewhere referred to. Subscription rates given on application.
- (f) "The Gas Equipment of the Home." 48-page illustrated booklet giving information on the many uses of gas in the home. It treats of the following:
 1. Plan of House Showing Piping Outlets.
 2. Gas Appliances for Each Room in the House.
 3. Hygiene of Gas; Its Aid in Ventilation.
 4. Modern Gas-Lighting; Treatment of Different Rooms.
 5. Plan of an Ideal Kitchen; The Modern Gas-Kitchen.
 6. Water-Heating by Gas; The Most Rapid System of Heating Water.
 7. Outdoor Residence Lighting.
 8. Flue Connections.
 9. Gas-Furnace Heating and Room-Heating.
 10. Gas Laundry Equipment.
 11. Sterilizing Water by Gas.
 12. Refuse Destroyer.
 13. Garage-Heating by Gas.
 14. Vacuum Cleaning by Gas.
 15. Refrigeration by Gas.
 16. Heating of Kitchen from Cellar Furnace.

17. Room-Heating Calculations.
 18. Gas for Domestic Science Equipments.
 19. Gas Piping, Piping Schedule, Meters.
 - (g) Certain committee reports are also issued separately, such as Report of the 1916 Committee on Standardization of Gas Appliance Specifications.
 - (h) Standard Gas Range Specification.
 - (i) Standard Gas Fixture Specification.
 - (k) Miscellaneous publications, which will be referred to under other subdivisions.
- Any of the above, except the "Proceedings" and those publications with prices affixed, may be had without charge by a practising architect or other qualified inquirer upon application to the Secretary.

This Association was organized in 1905 to act as a clearing-house of commercial information in the gas industry, to develop the use of gas, to promulgate methods for its sale, and to encourage the manufacture of efficient and suitable appliances for the use of gas for light, heat, power, or whatever proper purpose intended.

7A4 International Acetylene Association

Secretary: A. Cressy Morrison, 42d St. Building, New York City.

Publications:

Beginning with August, 1917, the *Acetylene Journal*, established in 1899, and the official organ of this Association, will be published in two separate editions monthly:

- (a) *Journal of Acetylene Lighting.*
- (b) *Journal of Acetylene Welding.*

These contain articles concerning the generation and utilization of this product and (c) a list of textbooks and other publications relating to acetylene and oxy-acetylene subjects.

The organization is composed of manufacturers of apparatus for the use of acetylene, manufacturers of carbide and oxygen, and all interested in the advancement of the acetylene industry. Its activities are devoted to the broader questions of the use of acetylene with the greatest possible safety.

7B Other Gas Organizations

The National Commercial Gas Association and the Society of Gas Lighting have no affiliated associations. The following associations are affiliated with the American Gas Institute: Illinois Gas Association, Horace H. Clark, Secretary, 1325 West Adams St., Chicago, Ill.; Indiana Gas Association, James W. Dunbar, Secretary, New Albany, Ind.; Iowa District Gas Association, T. B. Genay, Secretary, Des Moines Gas Company, Des Moines, Iowa; Michigan Gas Association, Clark R. Graves, Secretary, Lansing, Mich.; New England Association of Gas Engineers, N. W. Gifford, Secretary, East Boston, Mass.; New Jersey State Gas Association, O. F. Potter, Secretary, Public Service Gas Company, Newark, N. J.; Pennsylvania Gas Association, L. R. Dutton, Secretary,

Wyncote, Pa.; Wisconsin Gas Association, Henry Harman, Secretary, Milwaukee Gas Light Company, Milwaukee, Wis.; Southern Gas Association, E. D. Brewer, Secretary, General Gas Light Company, Atlanta, Ga.

There is also the Society of Gas Lighting, which was instituted December 1, 1875, and therefore is one of the oldest of the gas associations, but is more of a social organization than a technical one. George S. Ramsdell of New York is secretary.

There is also the Natural Gas Association which devotes its activities to considerations affecting the distribution and utilization of this product of nature.

7C Supplying Buildings with Gas

Dismissing from present consideration the properties, manufacture, and distribution of natural and artificial gases (which will be elsewhere referred to), the matter of supplying all buildings with gas for the fullest utilization thereof, whether for illumination, fuel, power, or heat, is of the utmost importance to architects, builders, and all occupants.

(For data on materials and methods of piping buildings for gas see 7E1, 2, and 3.)

1. A committee of the American Gas Institute, then called the Committee on Piping Large Buildings for Gas, presented at the annual meeting in 1914 a report of much interest. This report is incorporated in the Proceedings (7A2a) for 1914, and is separately printed (7A2k).

The following extracts are given for their suggestive value:

"As a purely financial investment it cannot be denied that the more complete the service that can be offered the more valuable as a rental proposition the building will become."

"Unless, therefore, the building is piped throughout on erection, this lack of provision may become a serious handicap in so far as the rental feature is concerned and may become a cause of loss of revenue."

"The use of gas is constantly being extended to new applications, and this development may be logically expected to continue indefinitely."

"Development in the application of gas to space-heating, by direct radiation, promises much, and this method . . . is sufficiently advanced to warrant the belief that in time it will come into general use, and such a possibility alone should have weight in planning the gas-supply systems for new buildings at the time of erection."

"Nevertheless, it is a fact that the too general practice at the present time is to erect the modern large building without making any provision for the utilization of gas as a source of light, fuel, and power. This lamentable condition can only be due to the lack of information on the part of the architect, owner, or builder of the many advantages of gas as an agent for light, fuel, and power, as well as the failure to have properly emphasized the considerable financial expenditure and inconveniences necessary to remedy this defect after the building is completed."

2. Desiring to emphasize the necessity for a standardized method of procedure in the matter of proper piping of buildings for gas, the first essential in any utilization of gas-supply, the Editor of the Structural

Service Department, previous to the inauguration of same, took advantage of an invitation to prepare a paper for the Mid-Year Conference of the National Commercial Gas Association, in June, 1916. Therein, the following reference to the subject was made:

"The first and most necessary step in our coöperation is that you furnish architects with information as to methods of installation for the piping of gas in all buildings. What form can this information take?"

"I would place at the very head of the list a 'National Electrical Code' in the gas industry. That is a misnomer, of course, but it will illustrate to you what I mean; namely, one dominant controlling factor in the installation of the arteries of service."

"A National Basic Code, with a piping schedule of minimum standards for sizes, lengths, and weights would, therefore, work to the great advantage of all good master plumbers and contractors who would be enabled to estimate under stable and equable conditions and to install their work without being at the mercy of varying individual judgment as to 'proper sizes,' etc."

"The piping schedule which your Association has this year adopted

is an important step in the right direction. I feel much honored to have had, as the Consulting Architect on Sweet's Catalogue Service, a hand in its preparation, and I hope that it may be taken up and criticized by the American Gas Institute, the American Institute of Architects, and all other interested bodies, and later adopted. But even as it is, if put to use by all architects and others to whom it is in this manner made available, it will be of incalculable assistance and value, for it may now be written into specifications."

3. See various sections of "Gas Equipment of the Home," the titles of which are given under 7A3f.

4. See Monthly Bulletin of the N. C. G. A. (7A3b) for April, 1917, in which is reprinted an article from the "Real Estate Bulletin" for January, 1917, recognizing the importance of supplying all buildings with gas by means of adequate piping for full equipment. In same is quoted data on this subject from *The Valve World* for April, 1916.

5. See "The Record and Guide," January 27, 1917. Article by Robert B. Mahn on "Coal Situation—Should Owners Install Gas Piping Much Possible expense might be Avoided."

7D1 The Proposed National Gas Safety Code

(NOTE.—The following information concerning the Code has been especially prepared for the Journal by the U. S. Bureau of Standards.)

(a) For some time the U. S. Bureau of Standards has had in preparation a National Gas Safety Code which shall cover a corresponding range of subjects and accomplish the same ends in safety to life and property as both the National Electrical (Fire) Code, which has for many years been the recognized authority as to standards of construction for electrical utilization installations within buildings, and the National Electrical Safety Code which the Bureau of Standards developed through an unprecedented coöperation of the electrical industry, and has recently published. The Gas Safety Code will thus have a double function, namely, fire-prevention and protection to life. The hazards which result from the manufacture, distribution, and utilization of gas are of such nature that generally the fire-hazard and the life-hazard cannot logically be separated. It is desirable, therefore, that, in discussing any phase of the general subject, both the fire-risk and the hazard of life should be recognized by the Code, and that rules be drawn to minimize both in so far as is practicable.

(b) The Bureau of Standards is carrying out this investigation and in the preparation of the Code desires to serve as a national coördinating agency to the end that the resulting Code will be acceptable and adequate, not only from the standpoint of the user of gas, but also for the casualty and fire insurance interests, the gas companies and their employees, and the gas appliance manufacturing and selling interests. Because of the wide variety of problems which arise in the work in different parts of the manufacture, distribution, and utilization of gas, and also because of the varied nature of the gases in commercial use, it has seemed desirable to arrange the Code so that each part will, in so far as is practicable, be addressed to a particular interest or group of interests and be convenient for their use. The Code is therefore divided into ten parts as follows:

1. Manufacture. 2. Distribution. 3. Appliance Design. 4. Gas Fitting. 5. Appliance Installation. 6. Natural Gas Wells and Field-Stations. 7. Acetylene. 8. Bottled-Gas Systems. 9. Blast-furnace, Producer, and Gasolene Gas. 10. Utilization—Information for Users.

(c) Parts 1 and 2 deal respectively with the production of manufactured gas and its distribution to the premises of the customer. They are therefore primarily of interest to the gas companies and their employees. Part 3, having to do with the design and construction of gas-consuming appliances, is addressed to the makers of such apparatus and to those handling it either in a wholesale or a retail way. Part 4 deals with gas-fitting and is primarily

addressed to the gas-fitter or plumber who is engaged in the installation of the piping, but is also of importance to the architect and builder. Part 5 deals with the installation and adjustment of appliance and is addressed to the same interests as Part 4. Part 6 has to do with the production of natural gas at the wells and its transmission through field pumping stations and high-pressure mains to the limits of the municipality. Part 7 is of primary interest to the users of acetylene and is addressed to the manufacturer of generating and other equipment, the distributor and the users of the gas. Part 8 deals with bottled-gas systems (Pintsch, Blau, Gasing-head gas, etc.). Part 9 is of interest both to the steel industry and to industrial plants since it deals with blast-furnace and producer gas, and also refers to the use of gasolene gas. Part 10 is addressed to the user of domestic and industrial gas-consuming appliances, and is largely non-technical in its nature.

(d) The two parts of the Code of especial interest to the American Institute of Architects are Parts 4 and 5, which deal particularly with installations on the gas consumers' premises. In brief they are as follows:

(e) Part 4 of the Code includes all regulations as to gas-fitting and the piping of buildings beyond the service meter. This part is addressed to gas-fitters, plumbers, and others who install piping on the consumers' premises, and its enforcement is a matter of piping or building inspection. It properly belongs under the jurisdiction of those municipal departments which should have ample jurisdiction to forbid the use of dangerous equipment and require removal of such equipment or discontinuance of gas service until proper alterations have been made to render the installation safe for the users from the standpoint of fire-prevention. The responsibility for new work being properly done, should, however, rest upon the fitter.

(f) Part 5 covers the subject of the installation and adjustment of gas-consuming appliances, gas-lighting fixtures and their accessories. These rules are addressed to gas-fitters, plumbers, appliance dealers, and others who make such installations on the consumers' premises. The enforcement of this part is a matter of appliance and building inspection and, like Part 4, properly belongs under the jurisdiction of municipal departments. Although the fitter should be entirely responsible for the work being properly done, the choice of appliances to be installed can be placed upon him to a limited degree. Where improper appliances are selected by an owner or architect and given to the fitter for installation, he should, if aware of the fact, advise the owner or architect as to the local regulation or desirable procedure to be followed in respect to these appliances, but if the owner or architect insists

upon the installation of such improper equipment they should be held responsible. The same authority covering the installation of dangerous appliances should be exercised by the municipal authorities as in the case of Part 4.

(g) Part 4 is approaching completion, and it is to be hoped that it and Part 5 will be in the hands of those interested for trial use within a short time. After such thorough trial, the Code will be amended where necessary before final recommendation by the Bureau and its conferees, in order to render it of greatest practicability, and it is the intention to keep the Code up to date whenever additional matter is deemed necessary or as good practice demands.

(h) The Bureau has been fortunate in having associated with it in this work representatives of the various professions and industries involved. The American Institute of Architects has designated Messrs. D. Everett Waid and

Julius Franke as advisors. The American Gas Institute, the National Commercial Gas Association, the Natural Gas Association, the National Fire Protection Association, the National Safety Council, the Public Health Service, and National Association of Master Plumbers have likewise coöperated, and the Bureau is glad to acknowledge its indebtedness to all of these various organizations for their assistance.

(j) It is hoped that when the Code is completed it will have the approval and sanction of all interested branches of the Industry so that it may be adopted by state and municipal authorities throughout the country as a reasonable working standard and thus will make unnecessary many diverse sectional specifications, such as preceded the National Electrical (Fire) Code, and have been more or less delaying the universal adoption of the National Electrical Safety Code.

7E Piping Buildings—Materials, Methods and Cost

See, also, the publications mentioned under supplying Buildings with Gas 7C in all of which piping is treated.

7E1 Information Obtainable

- (a) "Mechanical Equipment of Federal Buildings" (6L1e). Chapter V, "Gas Piping," contains a sample specification such as is used by the office of the Supervising Architect of the U. S. Treasury Department for a new building. Pp. 193-196.
- (b) See "Proper Specifications for, and Inspection of, Interior Gas Piping" (7A2m). Written for the Distribution Section of the ninth annual meeting of the American Gas Institute, October, 1914, by A. E. Turner.
This paper is printed in the "Proceedings" (7A2a) and may be separately obtained from the Secretary.
It includes "Necessity for Standard Specifications," "Present Practice in Some Large Cities," "Suggested Specifications," "Piping Schedules," and concludes with a table of "Comparison of Actual Sizes of Wrought Iron Pipe with the Theoretical Size."
- (c) "Architects' and Builders' Pocket Book," 1916, F. E. Kidder, pp. 1345-1350; Section on "Illuminating Gas and Gas-Piping" contains information on varieties of gas and gives General Principles and Requirements for Piping a House for Gas, with Rules and Table for Proportioning Sizes and a diagram piping.
- (d) "I. C. S. Handbook for Plumbers and Fitters." See section on Gas Fitting which contains data on size of pipes, installation and testing, and acetylene gas-fitting.
- (e) See "I. C. S. Building Trades' Handbook," p. 376, for information on cost of gas-fitting.
- (f) See N. F. P. A. "Index" (3A3h5) for reference to information on "Gas Mains."
- (g) See "The Installation of Cast Iron Street Mains" (7A2j).
- (h) In "Proceedings" of the N. C. G. A., 1916, is a paper entitled "Adequate Piping of Buildings," by W. T. Rasch, with discussions which followed it.
- (j) *Piping Symbols.* No standard set of symbols for marking gas outlets seems to have been developed.
 1. Gas outlets in combination with electric are, however, shown by the "Standard Symbols for Wiring Plans" mentioned under 6E4a.
 2. A "Key" to the symbols indicating gas outlets throughout a typical two-floor plan of modern dwelling is shown on p. 6 of "Gas Equipment of the Home" (7A3f1).
 3. "Standard Symbols for Gas-piping Plans" are shown on p. 1359 of "Kidder's Pocket Book" as referred to under 7M2.

7E2 Practice Recommended or Suggested by

- (a) American Gas Institute:
 1. See extracted comments from the Report of the Committee on Piping Large Buildings for Gas, under 7C1.
 2. This report also contained the following:
Piping Necessary.—The Committee realizes that a detailed table showing the size of risers, size of branch piping, number and size of fuel power and lighting outlets for various classes and size of buildings and for various spaces in them would be a great aid to the gas manager in working out his problems. However, the compiling of such a table would involve so many variables, and such a table would have to be in such great detail, in order to satisfactorily meet all conditions, that it has been thought advisable to endeavor only to give a few general sug-

gestions which it is believed can be followed with satisfactory results. For this purpose the space in large buildings has been divided into four main classes and the outlets necessary for each class given in a general way.

Classes of Space.—(1) Large areas in loft buildings used for storage or manufacturing purposes. (2) Large rooms in public or office buildings used as assembly halls, courtrooms, large offices and for miscellaneous purposes. (3) Rooms in office buildings used as offices. (4) Rooms in hotels and apartments used as reception-rooms, living-rooms, bedrooms, etc.

Outlets to be Installed.—(1) This is generally a case of exposed piping. Baseboard outlets (not less than 1¼ inches) should be installed at reasonable distances or to suit occupancy. Proper outlets should be installed for the lighting system. (2) One ample baseboard outlet (not less than 1¼ inches) should be installed for any possible future supply for gaseous fuel. Proper outlets should be installed for the lighting system, and modern attractive gas fixtures or combination gas and electric fixtures so designed that modern gas burners may be as easily and attractively used on them as may electric lights. (3) Usually one baseboard outlet (not less than ¾-inch) should be installed for connection of portable light or possible use of gaseous fuel. One or more ceiling outlets for the lighting system with fixtures as outlined in (2). (4) The larger rooms should be provided as in (2). The lighting system should also be as outlined in (2). The larger living-rooms and bedrooms should preferably have more than one baseboard outlet.

Cost of Piping.—The Committee has analyzed the cost of piping many buildings brought to their attention, from the simple case of piping a loft building, where the number of outlets is few, due to undivided space, and therefore the branch lines on each floor few in number, to the case of the complete piping of large office buildings for lighting outlets, baseboard outlets, fuel, and power requirements.

A list of buildings and comparative prices is then given in the report. These figures, both for the cost of the buildings and for gas installations would have to be proportionately increased to compare with prices now obtaining.)

From these typical, practical examples it can be seen that the gas-piping installation in a modern building, if put in at the time of erection, amounts to an extremely small figure, varying from 0.128 per cent to 1 per cent of the total cost of the structure for buildings varying from a loft building with its small number of outlets to the most elaborate piping of a modern office building.

3. Report of the Committee on Gas House-piping, as submitted to 1915 annual meeting of the A. G. I. (7A2l).

"The rules are divided for convenience into general specifications, building services, riser locations, outlets, fastening pipe, running of pipe in connection with walls, floors, etc., and the testing and inspection of piping."

A section is also devoted to rules and tables with explanations.

4. Report of the Committee on Gas House-piping, as submitted 1916. This is an extension of, and elaboration upon, the previous report with General Specifications, Rules, and Tables, so formulated that they would be applicable, with very minor changes, to any situation, the final decision in any doubtful case resting with the gas company.

While it expressly stated that it is a tentative specification only, and not endorsed by the American Gas Institute, it may well be looked upon, pending the final issuance of the National Gas Safety Code, as a standard to be followed in writing specifications for gas installations, where local building codes do not contain specific requirements, or for incorporation in specifications as the present standard to be followed with respect to all matters of workmanship and procedure.

(b) National Commercial Gas Association:

1. See "Piping Schedule" referred to under 7C2 and printed on p.

1296 of "Sweet's Architectural Catalogue," 1917, followed by "Explanation of and Directions for Using the Piping Schedule," and suggestions for outlets to be installed, appliances which may be used, and information on the general use of gas.

This is also issued as a reprint obtainable upon application to the Secretary.

- (c) National Board of Fire Underwriters:
 1. "Building Code" 1915, recommended by the N. B. F. U. (3A4d1). Sections 259 and 260 relate to Installations of Gas Pipes and Gas Appliances and contain valuable recommendations to be followed.
 2. "Dwelling Houses" (3A4d3). Another Code by the N. B. F. U. In Section 50 contains similar recommendations.
- (d) Proposed National Gas Safety Code. Read paragraphs (e) and (g) under 7d1 for informative data and recommendations shortly to be issued by the U. S. Bureau of Standards looking toward an eventual standardization of piping and fittings.

7E3 Standards to be Followed

- (a) By the Treasury Department, U. S. A. (Office of Supervising Architect):
 1. In "Mechanical Equipment of Federal Buildings" (6L), under "General Instructions Issued to Draftsmen," p. 365, it is stated: "All buildings must be piped for gas, even though there are no local gas works. This is a special departmental requirement."
- (b) The building codes of such cities as prescribe any regulations for gas-piping will naturally govern installations within the municipal jurisdiction. Some cities leave the matter entirely in the hands of the local gas companies, and in all cases where gas-supply is available inspection is made to determine the tightness of the supply-pipes before gas will be turned into the buildings. There remains, however, the installation beyond or in advance of service mains to be taken care of, and in order that the piping may be adequate and that equable conditions may prevail in the estimating specifications, should always provide

that the selected requirements and schedules referred to under "Practice Recommended or Suggested by" (7E2) should be followed and the completed installation be tested out as therein provided before any plastering is done.

- (c) "Present Practice in Some Large Cities" will be found covered in "Proper Specifications for and Inspection of Interior Gas Piping" (7A2m and 7E1b).
- (d) While the requirements before mentioned cover quite fully methods of installation and the manner of workmanship, there appears to be a lack of exact definition as to the standards of quality for the steel or iron pipe to be used inside of buildings.
 1. In report of the Committee on Gas House-piping (A. G. I., 1915) occurs the following:
Pipe and Fittings.—All pipe used should be of the best quality full-weight wrought iron or steel and free from defects. All fittings (except stop-cocks or valves) should be of full-weight malleable iron. Galvanized fittings are preferable.
 2. In the 1916 report of above Committee declares as follows:
Pipe and Fittings.—All pipe used shall be standard, full weight, of the best quality wrought iron or steel, and free from defect. All fittings (except stop-cocks or valves) shall be of best quality malleable iron. Galvanized fittings will be permitted and fittings galvanized on exterior only are preferred.
- (e) With respect to "Standards" for wrought or steel pipe used inside buildings, and for certain information on the subject of pipe, see April Journal 4F1, 4F2, and 4F3, especially 4F1f, which states that pipe will be more fully treated under later Serial numbers. (See 10J-11B2 and 11B6.)
- (f) The "Standards" for cast-iron gas-pipe used outside of buildings are, however, quite definite.
 1. "Standard Specifications for Cast Iron Pipe and Special Castings," American Gas Institute (7A2d); "Bell and Spigot Pipe and Special Castings," adopted 1911; "Flanged Pipe and Special Castings," adopted 1913. (These are quite independent of other standards for cast-iron pipe which will be referred to in next Serial number.)
- (g) For notes on electrolysis in connection with pipes, see 6N.

7F Gas and Its Utilization in Buildings

On the properties of the various gases and on the methods of production and use there is a vast amount of literature which lies outside our province to describe.

Reference will be made to certain publications, however, wherein these subjects are covered in connection with the general application of gases to industries connected with building construction or to their utilization within or adjacent to buildings.

For convenient reference see Gas Appliances in General 7H, included in which some of the applications have been placed under separate subdivisions such as for heating of space, heating of water, cooking, and illumination.

Other sources of information giving descriptions of products, their storage, distribution, and utilization, will be listed under the following main heading, entitled:

7G Properties, Power Equipment and General Uses

1. The various bureaus of the United States Government at Washington issue circulars, bulletins, technical papers and other publications which contain authoritative information of the widest range, all of which may be obtained from the Superintendent of Documents, Washington, D. C. A list of the most important of these, as concerns gas investigations and data, mostly of interest to the producer rather than the consumer, is given in the Monthly Bulletin of the N. C. G. A. (7A3b), May, 1917, p. 291, and June, p. 342.
2. The "Gas Chemists' Handbook" (7A2c) and other publications of the American Gas Institute, including the "Bulletin of Abstracts," a classified record of technical articles (7A2f).
3. "Industrial Fuel Reference Books" (7A3c) and other publications of the National Commercial Gas Association, including "Gas Equipment of the Home" (7A3f3).
4. Also, "Utilization of Gas Appliances" (7A3d), No. 10, entitled "Principles of Industrial Fuel."
5. Various periodicals and current publications covering subjects under this general heading are listed in each issue of the "Monthly Bulletin" of the N. C. G. A., as mentioned under 7A3b.
6. "Mechanical Engineers' Handbook," 1916, Lionel S. Marks, Editor-in-Chief. Read Index to same for references to properties of all gases and gas equipment of all kinds, including gas engines, gasoline engines, and power plants.
7. "American Civil Engineers' Pocket Book," 1916, Mansfield Merriman, Editor-in-Chief. Read Index to same for references to information on gas, gas-producers, and gas equipment for power and other purposes.
8. "Mechanical Engineers' Pocket Book," 1916, Wm. Kent. Read Index to same and refer to Gas, Fuel-Gas, Water-Gas, Producer Gas, Illuminating Gas, Acetylene and Calcium Carbide, and other information including that on gas engines.
9. "Architects' and Builders' Pocket Book," 1916, F. E. Kidder; Thomas Nolan, Editor-in-Chief; pp. 1345-1350: Section on "Illuminating Gas and Gas-Piping" contains succinct information on five varieties of gas, namely: Coal-Gas, Water-Gas, Natural Gas, Acetylene-Gas, and Gasoline-Gas, and gives General Principles and Requirements for Piping a House, as mentioned under 7E1c.
10. "Lefax Data Sheets," issued under the branches Mechanical and Chemical, for extracts from articles in scientific, technical and governmental publications on the subjects covered by this heading.
11. In "I. C. S. Handbook for Plumbers and Fitters" will be found a section on Gas and Gas-Fitting which treats of the different kinds of gas, pressure, measurement of flow, meters and regulators, and gives data on piping, acetylene generators, etc., as mentioned under 7E1d and 7L.
12. The above Handbook is independent of four volumes on "Steam and Gas Engineering" and two volumes on "Plumbing and Gas-Fitting" in the extensive International Library of Technology, each of which treats the subject exhaustively.
13. "Universal Safety Standards" (6E3f), pp. 25 and 74-79, contains information on gas engines, with illustrations showing how various types of engines should be guarded.
14. N. F. P. A. "Index" (3A345) contains reference to information on "Coal-Gas," "Gas Engines for Fire Pumps Supplying High Pressure Service at Philadelphia," "Physical Properties of Gas," and references throughout to information concerning all kinds of gases, their production, and proper means to follow in installing and utilizing.
15. "Field Practice" (3A3d1). Chapter III on "Power Hazards" contains Section 3 on "Gas and Gasoline Engines," giving information on the installation and inspection of these devices,

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- pp. 77-79. Other information in this publication is elsewhere referred to, including 7L.
16. "Standard Regulations for Fire-Protection and the Safeguarding of Hazards" (3A3a), adopted by the N. F. P. A. and the N. B. F. U.
 - (a) Acetylene-Gas Machines, Oxy-Acetylene Heating and Welding Apparatus and Storage of Calcium Carbide.
 - (b) Fuel Oil, Storage and Use, and Construction and Installation of Oil-burning Equipments.
 - (c) Gas Shut-off Valves.
 - (d) Gasolene Vapor Gas-Lighting Machines, Lamps and Systems.

- (e) Internal Combustion Engines (Gas, Gasolene, Kerosene, Fuel-oil) and Coal-Gas Producers (Pressure and Suction Systems).
17. See publications of the Underwriters' Laboratories for mechanical appliances and materials inspected and labeled or approved with names of the articles and manufacturers:
 - (a) "List of Inspected Mechanical Appliances" (3A6b).
 - (b) "List of Appliances Inspected for Accident Hazard" (5G3j).
18. For publications relating to "Oxy-Acetylene Welding Practice," see list which can be obtained as mentioned 7A4c.

7H Gas Appliances in General

The appliances chiefly used in buildings, outside of the industries, will be referred to under the separate subdivisions which follow:

This main heading is provided in order to refer to a few suggestions or requirements common to the utilizations of appliances in general. These are independent of those to be covered eventually by the National Gas Safety Code, the purpose of which with respect to appliances is well set forth in paragraphs (f) and (g) under 7D1.

1. Standards along the line of manufacture and installation are being developed by a Committee of the American Gas Institute on Utilization of Gas Fuel Appliances and a Committee of the National Commercial Gas Association on Standardization of Gas Appliance Specifications, the latter of which has already issued two standard specifications elsewhere referred to. These Committees are also developing a standard for flexible gas tubing, the safe manufacture and proper precautions in the sale of which are to be greatly encouraged.
2. The Manufacturers' Section of the N. C. G. A., under its separate organization, is coöperating in the development of other standards.
3. "Utilization of Gas Appliances" (7A3d).
 - (a) No. 3 Supplement.—Elementary Principles of Construction and Utilization of Energy.
 - (b) No. 6.—Hotel and Restaurant Appliances.
 - (c) No. 9.—Miscellaneous (Domestic) Gas Appliances.
4. Industrial Fuel Reference Books (7A3c).
5. The "Gas Equipment of the Home" contains several sections applicable to this subdivision. (Note the contents listed under 7A3f.)

6. In 5 as well as in the information referred to under 7E2b and some others is illustrated and described a gas receptacle the installation of which at frequent intervals makes possible the attachment and use of any desired appliance and by affording choice in the location of same subsequent to the piping gives extreme mobility to the furniture, fittings, and fixtures in any room or space.
7. "Building Code Recommended by The National Board of Fire Underwriters" (3A4d1), Section 260, relates to Installation of Gas Pipes and Gas Appliances and contains valuable recommendations to be followed in locating and connecting the latter.
8. The same Code on p. 175 gives recommendations for the construction and use of flues for gas-burning appliances. The important subject of flues is also treated under "Gas Equipment of the Home" and is especially covered in the publications relating to various appliances referred to under some of the subdivisions, especially 7K5a and b.
9. "Dwelling Houses" another code of the N. B. F. U. (3A4d3), in Section 50, contains similar recommendations.
10. Much valuable information on the subject of installations will be found in "Field Practice" published by the N. F. P. A. (3A3d1). Consult Index to same.
11. Other information in the publications of the N. F. P. A. may be ascertained through the "Index to Subjects" (3A3k5).
12. Some gas companies maintain an architects' service department, those with which the Editor is familiar being within the Consolidated Gas Company of New York, the New Haven Gas Light Company, and the United Gas Improvement Co. of Philadelphia, the latter of which distributes data sheets, of Institute standard 8½ by 11 size, intended for the files of architects. These include detailed drawings as well as other data on all kinds of appliances.

7J Space-Heating by Gas

This subject is engaging more and more attention, and developments are continually taking place. The Committee of the A.G.I. reporting in 1914 (see 7C1), referred to gas heating, especially individual space units, as in time coming into general use, which possibility it stated should have weight in arranging for gas supply at the time of erecting all buildings.

The means of accomplishment are varied, running from gas-grates, gas-logs, fireplace burners, wall-heaters, and portable heaters, to gas-fired furnaces, boilers, and radiators. The results, according to the systems used, are attained through hot air, steam or hot-water direct radiation, or hot-air radiation.

1. Reference to some of these methods is made in "Gas Equipment in the Home," 7A3 (f), for which read the contents there printed.
2. The Committee on the A. G. I. on Utilization of Gas Fuel Appli-

ances made a very complete report to the 1916 Convention, which is fully printed and illustrated on pp. 956-988 of Part 11 of the "Proceedings," 1916, (7A2a). This included illustrations of various types of blue- and luminous-flame heaters, with results of tests on distribution and quantity of radiant heat, diagrammatically expressed and much data on appliances in general and on flexible tubing.

3. A committee of the N. C. G. A. exists for the investigation and development of heating by gas. This is known as the Committee on Auxiliary Heating, George S. Barrows, Chairman. This Committee at the 1916 Convention made a most interesting and very complete report, which is printed and fully illustrated in the "Proceedings" for that year (7A3a), pp. 330-396.
4. "Utilization of Gas Appliances" (7A3d), Pamphlet No. 8, entitled "House-Heating Appliances."
5. The Consolidated Gas, Electric Light and Power Co. of Baltimore has issued a 23-page booklet on various phases of this subject, entitled "House-Heating with Gas in Baltimore a Success."
6. Concerning a system of space-heating by gas see the information published in the Industrial Section by the Hugo Mfg. Company, "Ventilating Gas Radiators"—Hawks System, p. 176.

7K Water-Heating by Gas

1. This subject will be found treated in but few of the pocket books and handbooks referred to elsewhere. Precise information has frequently been difficult to acquire, even the manufacturers themselves not furnishing it in the form required by architects to assure in advance the most satisfactory service through the best and most economical use of each appliance. A realization of this has led some manufacturers to prepare handbooks and data sheets quite independent of the usual catalogues, and some gas companies have prepared data sheets for the especial use of architects as mentioned under 7H12.

2. This subject is, in coöperation with the Manufacturers' Section, receiving the attention of a committee in the National Commercial Gas Association on Standardization of Gas Appliance Specifications, also referred to under 7H1.
3. In "Gas Equipment of the Home," 7H3f, will be found (6) Water-Heating by Gas; the Most Rapid System of Heating Water.
4. Very complete information may be found in the "Lessons" referred to under 7A3c, which cover the subject of water-heaters, from a historical review through operation, methods of use, principles

of water circulation, sizes of heaters, connections and flues, to care, efficiency, and maintenance.

- (a) Lesson No. 3, 1916, is entitled "Water-Heating—Circulating Types."
 - (b) Lesson No. 10, 1916, is entitled "Water-Heating—Automatic Types."
5. For most complete and exhaustive data on water-heaters in general, see the series of pamphlets 7A3d "Utilization of Gas Appliances." These are fully illustrated and contain diagrams, tables, calculations, descriptions, and recommendations of the greatest usefulness.
- (a) No. 4 is entitled "Circulating Water-Heaters for Domestic Purposes," and is divided into sections on: Evolution of the Heater; Combustion; Efficiency; Water-Circulation; Types of Circulating Water-Heater; Combination Boiler and Gas Water-Heater; Gas-Cock; Flues; Boilers and Connections; Causes of Rusty Water; Comparison with other methods of Heating Water; Comparative Costs—Coal and Gas; A Practical Method of Making Efficiency Tests.

(b) No. 5 is entitled "Instantaneous Automatic Water-Heaters; Multi-Coil Storage Systems and Instantaneous Bath-Water Heaters" and is divided as follows:

1. Historical Review.
 2. Construction: Gas burners, heating surfaces, shell, water-valve, gas-valves, thermostat, draft-hood.
 3. Operation.
 4. Installation: Flue conditions, water and gas supply, location, reheating or supplementary system, installation specifications, drawings and data.
 5. Care and Maintenance.
 6. Selection of type and size; special uses.
 7. Comparative costs of gas and coal.
6. For informative data on gas water-heaters see the p. 212 in the Industrial Section, of the Humphrey Co., division of Ruud Mfg. Co., also, see various catalogues of the Humphrey Co., and the very complete Handbook of the Ruud Manufacturing Co., entitled Gas Water Heaters, copyright 1915.

7L Cooking and Hotel and Domestic Appliances

Aside from the illustrated literature of the gas associations and companies, the publications in connection with gas for cooking and other domestic conveniences are chiefly those of the manufacturers of the appliances, whether they be used for home, hotel or laundry—club, cantonment or other permanent or temporary use. There will, however, frequently be found articles of suggestive value and usefulness in the many periodicals, lists of which have been mentioned, and in the many popular magazines.

1. Attention is directed to the Section on Gas Appliances in General and to the work of the Committees on Standardization of Gas Appliance Specifications referred to therein under 7H1.
2. The Gas Equipment of the Home (7A3f) takes up the use of gas for cooking and for other forms of domestic utilization separately. It shows the plan of an "Ideal Kitchen" and contains illustrations and suggestions relating to the manifold uses of gas throughout the home, treats of hoods and canopies and other accessories and contains subdivisions which cannot be fully described in the contents listed. It also mentions Domestic Science Equipment in Schools.
3. Under the "Lessons" referred to in 7A3e are those relating to various domestic equipments.
4. See especially "Utilization of Gas Appliances" (7A3d).
 - (a) No. 1, is entitled "Domestic Cooking Appliances."
 - (b) No. 6 is entitled "Hotel and Restaurant Equipment."

5. See also the very complete Industrial Fuel Reference Book (7A3e) No. 6, which is entitled "The Application of Gas to Hotel and Restaurant Equipment."
6. See article on "How to Secure All-Gas Kitchens in old Houses" by H. K. Dodson, reprinted from "Proceedings" of the N. C. G. A.
7. See the sections of Field Practice (mentioned under 7H) applicable to the installation of the appliances alluded to under this subdivision.
8. Building Code recommended by the National Board of Fire Underwriters (3A3d1) has a Section No. 260 relating to installations of gas-pipes and appliances and contains recommendations to be followed in installing various domestic appliances.
9. "Dwelling Houses," another Code by the N. B. F. U. (3A3d4) in Section 50, contains similar recommendations.
10. See publications of Underwriters' Laboratories referred to under 7G17.
11. Read paragraphs (f) and (g) of 7D1 describing the proposed National Gas Safety Code.
12. Of interest as affording the standards to be followed in manufacture, see Standard Gas Range Specifications adopted by the National Commercial Gas Association, 1914.

7M Illumination—Fixtures, Equipment and Ignition

On the general subject of illumination and the modern science of illuminating engineering read the interesting account of the Illuminating Engineering Society under 7N1 prepared for the Journal through the courtesy of Wm. J. Serrill, President.

See, also, the various publications referred to under 6H, most of which treat of illumination by gas as well as by electricity.

1. No more fitting introduction to the subject of illumination by gas could be printed than the following excerpts from the Report of the Committee of the American Gas Institute referred to under 7A2k as they treat of developments in fixtures, mantles, and ignition to suit all modern requirements.

(a) "With the latest developments in both inverted and upright incandescent mantle burners, gas can be applied to all forms of illumination—direct, semi-indirect, or indirect. These units, made in several sizes, giving a light from the smallest intensity commercially used to a light of as high intensity as needed for any indoor work, with the great variety of glassware which it is possible to use, are made up in fixtures varying from the plain, simple, inornate fixture suitable for purely commercial lighting, to the rich, heavily ornamented fixture for use in the handsomest surroundings."

"This is not only true of the direct lighting units but especially true of the semi-indirect units where we find gas peculiarly adapted for use with the large variety of beautiful glassware that has been developed for this system of illumination. This attractiveness applies equally well to the numberless portable lamps with their rich shades of many styles and designs, suitable for the living-room, library, bedroom, den or boudoir."

(b) Ignition.

"Directly connected with the consideration of appearance comes the question of flexibility. Gas units are now placed on the market in varying sizes. Allied closely with this question of flexibility comes that of control of the units themselves. This means the method of lighting and extinguishing. Before the advent of the incandescent mantle light, gas-lighting usually required the use of matches and the manual lighting of each and every lamp."

"Simultaneously with the development of the mantle unit, however, came the invention of several methods for lighting and extinguishing lamps, and several methods of control, from a distance, until at the present time no installation can lay any claim to being modern or complete that requires the use of matches for ignition. We now have available these distance-control systems, and also local control, with single pendent switch or chain, similar in all respects to the electric local control. Here the ignition is accomplished by a pilot light. This system has been in operation for many years and gives entire satisfaction."

(c) Distance Control.

From the many distance-control systems available, there are several which have been used in actual service and have proved reliable and dependable. These are the magnet cock with pilot ignition, the magnet cock with jump-spark ignition, a system using the gas pressure for control and igniting by pilot light, and the hot-wire, or filament, ignition in combination with the magnet cock. In actual operation in various installations these have given satisfactory service. Gas, therefore, has all the features of convenience of any of the commercial illuminants. (In the Appendix, Section D of the Report (7A2k) will be found a short description of each of these systems with diagrams indicating their method of operation.)

2. See "Architects' & Builders' Pocket Book," 1916, F. E. Kidder, pp. 1351-1370: Section on "Lighting and Illumination of

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- Buildings," by W. H. Timbie, contains portion devoted to Illumination of Gas and gives general information, tables, and diagrams; Table V, being a chart of "Standard Symbols for Gas-Piping Plans" as developed by the Illuminating Engineering Laboratories of the Welsbach Company.
3. For a list of "Reference Books on Illumination," including those of some manufacturers, see p. 1370 of Kidder's "Pocket Book."
 4. "Mechanical Equipment of Federal Buildings" (6L1g), Chapter VII, "Lighting Fixtures." This gives "Basic Data in Connection with Design and Installation of Lighting Fixtures" and data for estimating the cost of same. It also includes a "typical lighting fixture specification prepared by the office," which covers various types of fixtures, glassware, reflectors, metals, gas-piping, and finish, and gives a schedule of fixtures and notes on inspection and tests.
 5. In the "I. C. S. Handbook for Plumber and Fitters" is a section on gas-fitting in which are given data on illumination and piping, including piping for acetylene gas-lighting with the requirements of the New York Board of Fire Underwriters for the installation of acetylene-gas generators and recommendations as to the location of gas fixtures. The subject of "electric gas lighting" is also covered.
 6. "Residence Lighting," by W. A. Morris. A 14-page illustrated booklet which contains information on what constitutes satisfactory domestic lighting for the various rooms of the average residence and what units are available.
 7. "Some Phases of the Illumination of Interiors," by Preston S. Millar. A paper and demonstration presented at the eighth annual meeting of the American Gas Institute (joint session I. E.S. and A.G.I.), October, 1913. Treats of "Lighting Effects." 28 pp., illustrated. (Printed in "Transactions" of I.E.S., Vol. VIII, p. 99, 7A1a.)
 8. See pamphlets of the National Commercial Gas Association "Utilization of Gas Appliances," 7A3d.
 - (a) No. 2 is entitled "The Production of Light."
 - (b) No. 3 is entitled "Planning Lighting Installations."
 9. "Gas—The Modern Home Light," 1916. 34-page illustrated booklet issued by the N.C.G.A. (7A3g), being a guide in selecting gas-lighting for each room. Contains "Ten Rules of Gas Light."
 10. "The Gas Equipment of the Home." Various sections described in the contents given under 7A3f.
 11. "The Hygienic Value of Gas Lighting," by R. F. Pierce. 20-page booklet reprinted from the *Illuminating Engineer*; treats of the beneficial effect of gas light upon the air, and its hygienic effect upon the eyes.
 12. "Gas Lights for All Purposes." 63-page illustrated booklet issued by the United Gas Improvement Company of Philadelphia; illustrates and gives cost data on direct and indirect lighting fixtures of every description, portable lamps and floor standards, as well as mantles and glassware for lighting fixtures.
 13. "Mechanical Engineers' Pocket Book," 1916, William Kent, pp. 1468-1477: Section on "Illumination—Electric and Gas Lighting" contains general information and tables in connection with the use of gas for lighting purposes.
 14. "Crosby-Fiske-Foster Handbook of Fire Protection" (fifth edition), pp. 122-126: Section on "Lighting," contains recommendations covering illumination by various kinds of gas.
 15. For specific information in relation to the use of acetylene gas for illumination see publications of the International Acetylene Association and list referred to under 7A4a.
 16. In "Mechanical Engineers' Handbook," by Lionel S. Marks, the section on "Prevention of Accidents" by D. S. Beyer contains a division on "Lighting," which treats of the importance of adequate lighting in relation to the prevention of accidents.
 17. The Committee of the National Commercial Gas Association on Standardization of Gas Appliance Specifications (7H1) developed:
 - (a) Standard Gas Fixture Specification (7A3g) which was adopted by the Association, December, 1914.
 - (b) "Field Practice," Inspection Manual of the N.F.P.A., 1914, pp. 23-32, contains sections on "Lighting Hazards" with subdivisions on "Gas: Public Supply, Artificial and Natural," "Acetylene Gas," "Compressed or Liquid Gases," "Kerosene and Kerosene Vapor," "Gasolene Vapor."These give succinctly the processes of manufacture, applications for use and observations relating to installations and maintenance which should receive attention.
 19. N.F.P.A. "Index" (3A345) contains reference to information on "Illuminating Gas," "Gas Arc Lamps," "Gas Mantles," and other subjects of interest indicated by the contents.
 20. See the two Codes of the National Board of Fire Underwriters—the Sections referred to under 7E2c1 and 2 contain recommendations also as to location and kind of gas fixtures.
 21. Read paragraphs (f) and (g) under 7D1 relating to the proposed National Gas Safety Code.
 22. Standard Regulations for Fire Protection and the Safeguarding of Hazards (3A3a) adopted by the N.F.P.A. and the N.B.F.U., obtain with respect to generators for independent lighting systems, as follows:
 - (a) "Acetylene-Gas Machines, Oxy-Acetylene Heating and Welding Apparatus and Storage of Calcium Carbide" (7G16a).
 - (b) "Gasolene Vapor Gas Lighting Machines, Lamps and Systems" (7G16d).

(d) A committee has completed popular lectures on "Store Lighting" and "Residence Lighting" with accompanying lantern-slides. It is proposed to circulate these lectures among those who wish to present them before organizations interested in these phases of lighting. Three other lectures—on industrial lighting, office lighting, and elementary principles of lighting—are in course of preparation.

The Illuminating Engineering Society was organized in the year 1906 by a group of engineers in New York City who were interested in the subject of illumination.

At that date the profession of illuminating engineering was in its infancy. While the principles of light distribution, as a branch of physics, had been published, but little progress had been made in translating those principles into practice.

The public had not been educated so as to create a demand for proper illumination, and the manufacturers of lighting equipment, in the absence of such a demand, were groping in the dark as to the proper character of their equipment. The knowledge that there were such things as bad lighting, which is harmful to the eyes, and good lighting, which is not only harmless but a factor in conserving eyesight, was not widespread. That illumination is a factor in interior decoration and possesses a distinct esthetic value practically entered not into the conception of architects and interior decorators. That illumination is an important element in workshops, by increasing output, by reducing accidents, and by bettering the morals of workers, was not generally realized.

7N Illumination in General

7N1 Illuminating Engineering Society.

General Secretary, G. H. Stickney, 29 W. 39th Street, New York City.

[EDITOR'S NOTE.—The activities of this Society are concerned with all forms of illumination whether artificial or daylight.]

Public Information:

- (a) Publication of a periodical called the "Transactions," in which are printed papers dealing with all phases of the art and science of illumination.

The "Transactions" are free to all members. To other individuals, \$5 per year; to libraries, \$4; foreign subscriptions, 50 cents additional.

Single copies of current numbers, 55 cents to members and 75 cents to others. The Society will be glad to furnish sample copies, if available, to practising architects.
- (b) Publication of special pamphlets dealing with the particular phases of illumination. Among these may be mentioned the pamphlets entitled "Light: Its Use and Misuse," a "Code of Lighting Factories, Mills and Other Work Places," and a number of reports of committees of the Society.
- (c) The conducting in the year 1910 of an elaborate lecture course on illuminating engineering, jointly with the Johns Hopkins University, and the subsequent publication of reprints of the lectures. At the present time there is in course of publication a similar volume dealing with a second course of lectures on illuminating engineering jointly conducted in the year 1917 by the Society and the University of Pennsylvania. This treatise, the latest word on illuminating engineering, will be available after July 1.

During the ten years of its existence the Illuminating Engineering Society has wrought a wonderful change in the conditions of lighting. A formless mass of principles, theories, and practices has been coördinated so as to constitute a definite branch of engineering; questions of nomenclature and standards, which form the basis of any orderly engineering practice, have been solved and standardized; researches in the domains of both physics and physiology have been fruitfully stimulated; educational courses have been inaugurated; legislation has been, and is now actively being, guided along intelligent lines.

To the home-lover it has been shown that his evenings may be made more cheerful through proper lighting. Conservation of eyesight, increased decorative value of furnishings, an atmosphere of hospitality and warmth are among the things that good illumination secures. The lighting of work places—offices, stores and factories—has been improved, and the advantages of correct illumination have been demonstrated. Increased output, welfare of the worker, and a general betterment of the morals of the employees has resulted. Public halls, theatres, auditoriums, churches and all meeting-places required interior illumination—natural and artificial—which would give an atmosphere appropriate to the functions of the place, as well as the necessary illumination. Highway illumination demands more than the ability to see an approaching vehicle or pedestrian. The contour and architectural features of buildings may be so lighted that their esthetic value is retained during the hours of darkness. The parking and landscapes adjacent to the roadway may be seen by night as well as by day. Municipalities have been thus encouraged to improve the grounds surrounding public buildings and adjacent to highways. Studios, museums, and galleries of art afford a field for the development of illumination which is destined to awake a new enthusiasm in the artist and a new appreciation in the connoisseur. Intensity, color, and direction of light may be adjusted to give the effects which are so necessary to this class of illumination. The architect and artist need no longer leave out fine shades of color and delicate contours because of inadequate lighting.

With all these lines of endeavor clearly defined, the Society organized its members, sections, and committees. It received the hearty coöperation of the scientist, manufacturer, the fixture designer, and the gas and electric central station men. The coöperation of all users was represented in the demand for improved installations. Many other professions became interested and offered support to the movement—the architect, ophthalmologist, optician, and those interested in civic and municipal improvements.

During nearly eleven years of activity the Society has

aided materially in the present high development of lighting. The indirect and semi-indirect systems of illumination, the use of "daylight" illuminants and special color devices, the effective distribution of light from the modern lamps and shades, the development of flood-lighting and spectacular illumination are some of the things fostered by the Society. It should be emphasized that the Society stands for illumination and is strictly neutral and impartial as between the various artificial illuminants.

Among important investigations carried on by technical committees of the Society may be mentioned those of the Committees on Nomenclature and Standards, Glare, Research, Lighting Legislation and Education.

Through the coöperation of the Committee on Lighting Legislation, modeled on a code prepared by this Committee, several states have enacted legislation on this subject.

At the present time the Society has committees preparing reports on the following subjects: Automobile Headlamps, Railway Vehicle Headlamps, Street Lighting, Diffusing Media, School Lighting, Lectures to Architectural Students.

There are five sectional organizations of the Society. These sections hold regular meetings in their respective localities—New York, Philadelphia, Pittsburgh, New England, and Chicago. The membership of the Society numbers 1,300.

70 Addenda

1. In "Report of the Surgeon-General, U. S. Army, 1917" referred to under 9M2, it is stated, with respect to the Department Hospital at Manila, P. I.: "During the year the installation of gas throughout the hospital to replace the steam appliances for sterilizing purposes was started, and by Dec. 31 a steam boiler and a hot-water heater using gas as a fuel were erected and in working order, supplying steam for the kitchen of the general mess and hot water for the entire hospital.
"Each sterilizing apparatus throughout the hospital, in the wards, operating-room, and laboratory, has been equipped with a gas burner; they have been thoroughly tested and found satisfactory in operation, though requiring somewhat more care to avoid injury to apparatus than the former method of supplying steam from a central plant.
"Gas stoves for the general mess, sick officers' mess, and nurses' mess have been ordered from the States. When these are installed the entire steam and heating system of the hospital will be using gas."
2. An interesting contribution to the subject of furnishing architects with more adequate data on gas piping and appliances and the general utilization of gas in buildings will be found in the 1917 Report of the Committee on Relations with Architects, of the National Commercial Gas Association, published in the January, 1918, Bulletin of that Association. The Editor of the Structural Service Department, as a member of that Committee, welcomed the opportunity to make several of the suggestions embodied in the report.

Serial No. 8

So great is the present interest in the constructional activities of the United States Government that we are interrupting the sequential presentation of information in this department in order to give some account of the organization of those branches of the three departments of

the United States Government—War,* Navy, and Treasury—which have to do with structural matters. To locate descriptions, in various Serial Numbers, of the structural activities of other departments of the Government, consult “Contents” at front of Book.

*Unavoidably deferred to a future issue. (See “Office of the Cantonment Construction Division of the Quartermasters’ Department” in September Journal, p. 423, and “Office of the Signal Corps Construction Division,” p. 424 of same issue.)

AUGUST, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

- 8A** Bureau of Yards and Docks: Department of the Navy.
- 8B** Office of Supervising Architect: Treasury Department.
- 8C** Bibliography: The United States Public Works.
- 8D** The Convention of the American Society for Testing Materials.

8A Bureau of Yards and Docks: Department of the Navy

Established
in 1842

(Prepared for the Journal by Rear Admiral Harris)

Chief of Bureau: Rear Admiral Frederic Robert Harris,
U. S. N., Navy Annex Building, Washington,
D. C.

1. *Publications:*

Bulletin “Public Works of the Navy,” issued quarterly, January 1, April 1, July 1, and October 1; H. D. Rouzer, Engineering Secretary to Chief of Bureau, acting editor.

Information published in the Bulletin appears under the following heads: Administrative, Professional, and Engineering Notes.

Under the heading, Administrative, are published from time to time explanations of the manner in which the Bureau desires its work carried on, information relating to new contracts, reports of progress of work and work completed, reports of expenditures and analyses of expenditures, and matters relating directly to the administrative policy of the Bureau.

Under the heading, Professional, is published matter of professional interest to officers of the Corps of Civil Engineers, U. S. Navy, and includes proposed new methods of design; special cases of successful construction along new lines, as well as cases which may have proved unsuccessful; results of tests upon various manufactured articles which may be offered for use in public works; and cost data on the various works constructed under the cognizance of the Bureau. Articles descriptive of engineering projects of major importance prepared by members of the Corps appear under this heading.

Under the heading, Engineering Notes, is printed such matter as bibliographies, abstracts of published articles, etc., which it is considered will be of value as reference. Brief articles descriptive of engineering projects of somewhat minor importance are also published under this heading.

Bulletins are not for public distribution; however, it has been the custom to forward copies to parties on request, until the supply is exhausted.

2. *Administration:*

The duties of the Bureau of Yards and Docks comprise all that relates to the design and construction of public works of the Navy, such as dry-docks, marine railways, building ways, harbor works, quarry walls, piers, wharves, slips, dredging, landings, floating and stationary cranes, power plants, central heating plants, coaling plants, fuel-oil plants, heating, lighting, telephone, water, sewer and railroad systems, roads, walks and grounds, bridges, radio towers, hospitals, and all buildings for whatever purpose needed under the Navy and Marine Corps. It has charge

of all means of transportation, such as derricks, shears, locomotives, locomotive cranes, cars, motor trucks, and all vehicles, horses, teams, subsistence and necessary operators and teamsters, in the various navy yards.

The work of the Bureau is carried out under the direction of the Chief of the Bureau, assisted by the officers of the Corps of Civil Engineers, U. S. Navy. Six officers are detailed for duty at the Bureau, the remaining number being stationed at the various navy yards and naval stations and supervise the work in their respective localities.

3. *Organization:*

The Chief of the Bureau is in general charge of all work under the cognizance of the Bureau. In his absence the Assistant Chief of the Bureau is in charge.

The work of the Bureau is classified under the following main divisions, each under the direct supervision of a commissioned officer or the Chief Clerk:

(a) Assistant Chief of Bureau.

(b) Division of Mechanical, Electrical, and Routine Design.

(c) Division of Special Design and Projects.

(d) Construction Division.

(e) Maintenance and Operating Division.

(f) Clerical and Office Management Division.

(a) *Assistant Chief of Bureau:* This officer is the special representative of the Chief of the Bureau and Acting Chief in his absence. He has the general supervision of all correspondence, Bureau organization and office methods, annual estimates, and coördination of Bureau work.

(b) *Division of Mechanical, Electrical, and Routine Design:* This Division operates through three subdivisions—(1) General Drafting, (2) Mechanical and Electrical, and (3) Architectural.

The following are the more important duties of this Division: Origin and development of design of altera-

tions and extensions to existing public works and utilities and new projects of a routine character, and projects having architectural features of major importance.

Plans and specifications prepared at the yards, unless involving projects under the division of special design and projects. (See Division [c].)

All matters relating to radio work except contracts and records of yard-labor jobs.

All matters relating to power plant, mechanical and electrical work, except contracts and records of yard-labor jobs.

All matters relating to electric, water, power, air, and heat distributing systems accessory to power plants, except contracts and records of yard-labor jobs.

(c) *Division of Special Design and Projects:* This Division has the following among its general duties—

Origin and development of design, plans and specifications covering special projects involved in extensive development of the yards and stations.

Studies and plans for future development and expansion of yards and stations.

Studies and plans for standardizing public works structures.

(d) *Construction Division:* This Division has the following among its general duties—

Advertisements for proposals, opening of bids in Bureau and preparation of recommendation of award.

Work under Bureau contracts from date of contract. This includes arranging for factory inspection and shipment of materials and machinery.

All yard-labor jobs from date of authorization.

The officer having charge of this Division is the representative of the Navy on Committee on Portland Cement Specifications, on Waterproofing Cement, on Plumbing Board, and the representative of the Bureau on Cement Committee of the American Society for Testing Materials.

(e) *Maintenance and Operating Division:* This Division has the following among its general duties—

Supplies and accounts, requisitions and proposals; furniture records.

Allotment of funds under annual appropriations and allotment of funds under public works appropriations. Periodical reports of inspection of public works and utilities.

Inspection and shipment of material under supplies and accounts, contracts, or requisitions.

Subsurface and topographical surveys of yards and stations.

The officer having charge of this Division is the representative of the Bureau of Civil Service Examinations.

(f) *Clerical and Office Management Division:* This Division has the following among its general duties—

Supervision of Bureau clerical force.

Examination of legal provisions of specifications.

Preparation of Book of Yard Maps and data book, public works.

Office management, coordination routine and office work of divisions.

8B Office of Supervising Architect: Treasury Department

(Prepared for the Journal by James A. Wetmore, Acting Supervising Architect)

Publications:

The office does not publish a bulletin. Advertisements soliciting proposals are published in a number of technical papers and in local newspapers. A number of papers make a specialty of reporting awards of contracts. The Society of Constructors of Federal Buildings, consisting of the members of the field force and some members of the office force, issues a monthly journal which, although not an official publication, gives much information regarding the activities of the office.

Administration:

The activities of the Office cover all that relates to the design, construction, and maintenance of public buildings in all parts of the country, such as post offices, courthouses, custom houses, appraisers' stores, power houses, departmental office buildings, wharves, marine hospitals and quarantine stations, in fact, practically all buildings for civic purposes.

With the exception of departmental office buildings, it furnishes the buildings, keeps them in repair, and controls and directs the force required for their maintenance.

It furnishes estimates for new projects for the information of Congress and conducts an extensive correspondence in relation to the buildings under contract and completed and in relation to new materials and methods of construction.

The Office does not buy any material direct but contracts for the construction of buildings and supervises the work of the contractors through the agencies of superintendents of construction and inspectors. After completion buildings are placed in charge of custodians.

Exclusive of marine hospitals, quarantine stations, and buildings which have been transferred to other Departments, there were under the control of the office on July 1, 1917, 1,072 completed buildings, of which approximately one-third have been extended, some more than once.

There are 54 marine hospitals and quarantine stations, each containing a considerable number of buildings. Practically every quarantine station has one or several wharves.

From 80 to 90 buildings are placed under contract every year and approximately the same number of buildings are completed every year. The yearly average expenditure for new construction work is \$8,000,000, and approximately the following amounts are expended per year for completed buildings.

Repairs and preservation	\$800,000
Mechanical equipment	440,000
Vaults and safes	110,000
Furniture and repairs to furniture	775,000
Operating force	3,025,000
Operating supplies	1,700,000

Organization:

(a) The Supervising Architect directs all activities of the Office with the assistance of the Executive Officer in charge of the administrative divisions and the Technical Officer in charge of the technical divisions; both officers are authorized to sign a certain class of mail. In the absence of the Supervising Architect, these two officers in the sequence given become acting head of the Office.

(b) The Technical Officer directs the following divisions, each in charge of a superintendent of division:

1. Drafting.
2. Structural.
3. Mechanical Engineering.
4. Computing.

(c) The Executive Officer directs the following divisions, each in charge of a superintendent of division:

5. Maintenance.
6. Files and Records.
7. Accounts.
8. Repairs.

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As this is division by subject and not by territory, the coöperation of the eight divisions is required in connection with every building.

(d) *Board of Award*: All expenditures are passed by the Board of Award, which sits daily and consists of four members, the Supervising Architect, Executive Officer, Technical Officer, and Superintendent of the Drafting Division.

Recommendations to the Board for expenditures are made by the Superintendents of Computing, Mechanical Engineering, Maintenance and Repairs Divisions. The letters authorizing expenditures are written by the Computing and Maintenance Divisions.

(e) *Technical Board*, consisting of the Supervising Architect (*ex officio*), Technical Officer and Superintendents of the Drafting, Structural, Mechanical Engineering, Computing and Repairs Divisions.

The principal duties of the Board are to consider technical processes, pass on important questions relating to materials and methods of construction, and secure the fullest coöperation between the different technical divisions. This Board convenes only when called by the chairman.

(f) *Construction Field Force*, comprises 105 superintendents of construction, transferred from point to point as their services are required. As there are constantly from 125 to 140 buildings under construction, some of the superintendents have charge of more than one building.

The traveling inspection force consists of five Supervising Superintendents and seven Mechanical Inspectors. The Supervising Superintendents and Inspectors are stationed in large cities and each covers the inspection work of a certain territory.

(g) *Custodian Force*: Each completed building is in charge of a custodian, who is a Government official and serves without compensation. The force of janitors, firemen, laborers, etc., varies greatly with the size of buildings. Four traveling inspectors report on the efficiency of the custodian force and the maintenance of the buildings.

Duties and normal strength of the different divisions:

1. *Drafting Division*:

Superintendent, Assistant Superintendent, 1 Principal Draftsman, 4 Foreman Draftsmen, 43 Architectural Draftsmen, 3 clerks, and 1 messenger.

Duties: Designs for the approval of the Cabinet Board; architectural working drawings; approval of architectural samples and models; recommendations for mural decorations and decorative painting; construing architectural drawings; checking architectural shop drawings; memoranda as basis for correspondence; custody and maintenance of library; and preservation of files of drawings.

2. *Structural Division*:

Superintendent, Assistant Superintendent, 18 engineers, 1 clerk, and 1 messenger.

Duties: Structural drawings; checking structural shop drawings; approval of mill inspection reports; construing structural drawings; memoranda as basis for correspondence; and preservation of files of active structural drawings.

3. *Mechanical Engineering Division*:

Superintendent, Assistant Superintendent, 18 engineers, 3 clerks, and 1 messenger.

Duties: Mechanical engineering drawings and specifications for new and completed buildings; technical advice to Maintenance Division regarding expenditures in occupied buildings and engineering supplies and personnel; approval of mechanical engineering samples and selection of mechanical engineering appliances; construing mechanical engineering drawings and specifications; checking mechanical engineering shop drawings; memoranda as basis of correspondence; preservation of active mechanical engineering drawings and specifications; and recommendations to the Board of Award.

4. *Computing Division*:

Superintendent, 16 computers and estimators, 23 clerks, 5 skilled laborers.

In the Photograph and Duplicating Galleries, there are employed: 1 photographer, 1 foreman, 2 chemists, 4 skilled laborers, and 1 messenger boy.

Duties: Estimating for new buildings and extensions; reports on contemplated public buildings; writing of specifications; construing specifications; preparation of annual construction estimates; miscellaneous technical correspondence; recommendations to the Board of Award; authorization of expenditures from special appropriations; approval of structural samples; direction of movements of superintendents and inspectors (except inspectors of furniture and maintenance and site agents); management of all work on new buildings and extensions; all field correspondence; receiving, filing and shipping samples; in charge of duplicating and photograph galleries; files of active specifications; files of advertising; files of bids; list of awards; charge of contractors' room; and construction cost keeping.

5. *Maintenance Division*:

Superintendent, 24 clerks, 1 electrical engineer, 1 foreman vault, safe and lock shop, 1 messenger, 4 Inspectors of Maintenance, 1 Furniture Inspector, 1 Inspector of Vaults and Safes.

Duties: Authorization of janitors' miscellaneous supplies (fuel, electric current, gas, washing-towels, removing ashes, rubbish and snow, cutting grass, etc.); purchase of oil and lamps; purchase of coal.

Direction of custodian and janitor forces and engineering personnel; pay-rolls of custodian force.

Drawings and specifications for furniture; authorization of expenditures for same; furniture record; sale of old furniture; supplies and materials; sale of condemned property.

Purchase of carpets and linoleum; safes, lock-box equipment and vault repairs for completed buildings.

Charge of storerooms; issuing flags, towels, sponges, etc.

Charge of supply-room; purchase and distribution of office supplies; office printing; multigraphing, etc.

Correspondence relating to all of the above; Recommendations to the Board of Award from appropriations for operating supplies, furniture and repairs to same of public buildings, vaults and safes for public buildings, and general expenses of public buildings.

6. *Files and Record Division*:

Chief, Assistant Chief, 20 clerks, 2 skilled laborers, and 3 messengers.

Duties: *Law Section*.

Legal work generally; titles and title surveys; contracts and bonds; leases, licenses, and other instruments; correspondence and detail work in connection with sites and movements of site agents; authorizations from appropriation for "Lands and Other Property of the United States;" correspondence relative to claims; settlement of all contracts; responding to calls from Court of Claims; and legal correspondence.

Duties: *Files Section*.

All general files and records; incoming and outgoing mail; mailing specifications and drawings for Computing, Drafting, Structural, Repairs and Mechanical Engineering Divisions; preparation of miscellaneous forms and circular letters.

7. *Accounts Division*:

Superintendent, 19 clerks and accountants, 1 messenger.

Duties: Accounting and bookkeeping; statistical and cost-keeping systems; transmission of estimates for all appropriations and incidental correspondence in connection therewith; annual report; special and Congressional reports; office pay-roll, time-records, and leaves of absence of office force.

8. *Repairs Division*:

Superintendent, 4 draftsmen, 2 clerks, and 1 messenger.

Duties: Drawings, specifications, and estimates for repairs to completed buildings; technical advice, assistance and recommendations to the Maintenance Division; files of active drawings and specifications; approval of samples for repair work; and recommendations to the Board of Award.

8C Bibliography

In connection with the structural activities of the Government, the book by Col. W. M. Black, of the Corps of Engineers of the U. S. Army,

and member of the American Society of Civil Engineers, entitled "The United States Public Works" will be found instructive. It contains a

Summary of the Methods of Construction and Character of Materials and Plant used in the Public Works under the Charge of the War and Treasury Departments, and of the Commissioners of the District of Columbia, including Works of River and Harbor Improvement, Buildings at Posts of the United States Army, Lighthouses, Public Buildings, Life-Saving Stations, and Works of Municipal Engineering of Washington, D. C.; also of the Laws, Regulations, and Forms Prescribed for the

Conduct of Such Works; and a Directory of the United States Agents in Charge of These Works, and of Contractors for Them; also of Manufacturers of and Dealers in Machinery, Materials, and Miscellaneous Supplies Used in Construction of the Works. Published as a Book of Reference for All Persons Interested in the Public Works, and for Engineers and Contractors in General. 276 pp., illustrated with 56 half-tones and working drawings.

8D The Convention of the American Society for Testing Materials

August 13, 1917.

To the Editor of the Journal:

Dear Sir: I enclose the following notice relating to the recent annual meeting of the American Society for Testing Materials and embodying those matters which I deem of especial importance and interest to the architectural profession.

Yours very truly,

THOMAS NOLAN

Chairman Committee on Materials and Methods.

The Chairman of the Institute's Committee on Materials and Methods attended the twentieth annual meeting of the American Society for Testing Materials in Atlantic City, N. J., June 26-29, inclusive. There were 549 members in attendance. The Chairman attended all of the sessions of the four days and took part in the discussion of several of the reports and papers, especially in those relating to cement, reinforced concrete, and hollow building tile.

The American Institute of Architects as a body is a member of this Society, and the Chairman of the Committee on Materials and Methods has been, and is at present, the official representative of the Institute in that Society. That Society has made the Chairman of the Institute's Committee on Materials and Methods a member of its Committee C-1 on Cement and also of Subcommittee IX of that Committee C-1. Two other members of the Institute are members of Committee D-7 on Timber. Subcommittee IX on General Clauses and Publication has charge of the editing for publication this year of the Report of the Joint Conference which formulated the present Standard Specifications for Portland Cement.

Your Chairman has attended important meetings of Committee C-1 on Cement held in Philadelphia and in New York City and hopes to attend the next meeting of that Committee, to be held next October in Allentown, Pa.

Of the sixty-three reports and papers presented, the following were of special interest to the architectural profession:

1. Report of Committee A-2: On Wrought Iron.
2. Report of Committee D-9: On Electrical Insulation.
3. Report of Committee A-3: On Cast-Iron.
4. Report of Committee A-5: On Corrosion of Iron and Steel.
5. Report of Committee E-1: On Methods of Testing.
6. Distribution of Pressure through Earth Fills.
7. Annual Address by the President.
8. Report of Committee A-1: On Steel.
9. Inspection of Brass and Bronze.
10. Report of Committee D-1: On Preservative Coatings for Structural Materials.
11. Optical Properties and Theory of Color of Pigments and Paints.
12. Report of Committee C-1: On Cement.
13. The Properties of Cement-Lime-Sand Mortars.
14. High-Silica Portland Cement.
15. The Economical Proportions for Portland-Cement Mortars and Concretes.
16. Tests of Concrete Slabs to Determine the Effect of Removing Excess Water Used in Mixing.
17. Report of Committee C-2: On Reinforced Concrete.

18. Report of Committee C-9: On Concrete and Concrete Aggregates.

19. Report of Committee C-7: On Lime.

20. Effects of Grading of Sands and Consistency of Mix Upon the Strength of Plain and Reinforced Concrete.

21. A Comparison of the Heat-Insulating Properties of Materials Used in Fire-resistive Construction.

22. Report of Committee C-4: On Clay and Cement Sewer Pipe.

23. Report of Committee C-6: On Drain Tile.

24. Report of Committee C-10: On Hollow Building Tile.

25. Report of Committee C-5: On Fireproofing.

26. Report of Committee D-8: On Waterproofing.

27. Report of Committee D-7: On Timber.

At a meeting of Committee C-1 on Cement your Chairman fully explained to the forty members present the work and purposes of our Committee on Materials and Methods of the Institute, its desire to cooperate with the American Society for Testing Materials and other similar organizations, and also explained the Institute Committee's cooperation with the Structural Service Department of the Journal of the Institute. Your Chairman also explained to the members of this Committee the request made to all of our Chapter subcommittees to urge the Chapters of the Institute to consider the adoption of the A.S.T.M. Standard Specifications for Portland Cement and for Structural Steel for Buildings, and he stated that this was being done, some of our Chapters and one state association having already taken such action.

During the latter meetings of the Convention, Mr. D. Knickerbacker Boyd, the Associate Editor of the Structural Service Department of the Journal of the Institute, was in attendance and aided materially by offering valuable suggestions and taking part in discussions.

During the Convention your Chairman discussed informally with Mr. A. A. Stevenson, the retiring President of the American Society for Testing Materials, the advisability of some formal and official recognition on the part of that Society of the increasingly successful efforts of the Institute Committee on Materials and Methods and the Structural Service Department of the Journal to secure recognition and approval, and to adopt in practice the Standard Specifications of the American Society for Testing Materials. At the next annual meeting of that Society such action will probably be taken.

Your Chairman would urge, also, and will so recommend in the final report of this Committee, that at the next annual convention of the Institute formal action be taken affirming the A.S.T.M. Standard Specifications for Portland Cement and for Structural Steel for Buildings when these materials are to be used in architectural construction. (For Information concerning these two standards see the Journal for January, 1917.)

THOMAS NOLAN, *Chairman*
Committee on Materials and Methods

EDITOR'S NOTE.—It is of interest to note that one Chapter of the Institute, namely, Cincinnati, is a member of the American Society for Testing Materials and also that the Illinois Society of Architects is a member. (Since this was written the Philadelphia Chapter has become a member.)

Serial No. 9

PLUMBING ISSUE

HYDRAULICS—SANITATION—PUBLIC HEALTH

CONTENTS

A consideration of the subject of "Plumbing" involves at once a broad human problem which takes in the health of individuals, communities, and the country at large. There will, consequently, be found in this issue reference to considerations which include, first, the source of any water-supply, then its storage or impounding, its distribution, and its purification. Next comes its utilization, which has been considered with respect to the materials

and methods involved in general plumbing installations in and around all forms of human habitations. Finally comes the question of disposal of sewage and waste. Information and activities concerning all these subjects have been recorded as fully as possible within the limitations of a treatise devoted to aspects within the purview of architects and other constructionists.

SEPTEMBER, 1917

INDEX TO SUBJECTS TREATED IN THIS ISSUE

- 9A** U. S. Government Specifications and Publications. (See, also, 9M and 12H.)
- 9B** Public Health, Water Works, Plumbing and Other Associations.
- 9C1** Housing Associations and Other Volunteer Organizations.
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- 9C3** Educational and Research Work.
- 9D** Water-Supply, Storage, Utilization and Incoming Pipes.
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- 9K** Sprinklers and Fire-Protection.
- 9K2** Safeguarding Industry—A Wartime Necessity.
- 9L** Outgoing Pipes, Sewage Disposal and Public Health.
- 9M** United States Public Health Service.

9A U. S. Government Specifications and Publications

1. Composed of representatives of the Treasury, War and Navy Departments, there is a Board on Uniform Plumbing Specifications. This Board has issued (March 1, 1916) a "Specification for Plumbing Fixtures, etc., for the Treasury, War and Navy Departments."

It is stated that "These specifications are published for the purpose of facilitating construction in the governmental departments concerned. They are not to be construed as prohibiting the installation of any fixture desired for a special purpose and covered in the specifications for any particular work."

These specifications consist of 147 pages of printed matter, including 53 plates showing in detail all types of plumbing fixtures and their connections. They cover general requirements for all kinds of piping and various wares, and form the basis of the

specifications for each particular installation prepared by these departments. They are also so used by some architects in their regular practice.

These specifications may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at 75 cents a copy.

2. The Navy Department issues specifications for "Naval Stores and Materials," as described under 3A1a; those pertaining to plumbing materials, other than the fixtures and fittings referred to above, will be found completely listed in the "Index to Specifications" (3A1a1).
3. For publications by other governmental departments concerning materials, devices, and workmanship pertaining to hydraulics and sanitation, see the listings under the different subdivisions.

9B Public Health, Water Works, Plumbing and Other Associations

United States Public Health Service See 9M

9B1 American Public Health Association

Secretary: Salskar M. Gunn, 126 Mass. Ave., Boston.

Publications:

(a) "American Journal of Public Health."

(b) Also, "Standard Methods for the Analysis of Water, Sewage, Air, and Milk."

Its objects are to protect and promote public and personal health. The Association has seven sections: Laboratory, Public Health, Administration, Vital Statistics, Sanitary Engineering, Sociological Industrial Hygiene, and Food and Drugs.

9B2 American Society of Sanitary Engineering

President: Wm. C. Groeniger, State Health Dept., Columbus, Ohio.

Publications:

(a) Proceedings of Annual Meetings.

Composed of inspectors of plumbing, sanitary engineers, health officers, and others interested in its objects. Any manufacturer of sanitary goods is eligible as a contributing member. Committees of the Society engaged in work of interest to architects and builders are: on Research;

Causes of Iron Rust in Domestic Water-Supply; on House-Traps; on Standardization of Brass Goods; on U. S. Standards with respect to Plumbing Installation in Government Buildings.

9B3 *Water Works Associations*

Of great importance are the results accomplished by organizations formed to advance the design, construction, operation, and management of water works. These include:

9B3a *American Water Works Association*

Secretary: J. M. Diven, 47 State St., Troy, N. Y.

Publications:

1. The Journal of the American Water Works Association. Quarterly: March, and thereafter. Supplements give the proceedings of the annual conventions and lists of officers, committees, and members.
2. Standard Specifications for Cast Iron Water Pipe and Special Castings (adopted May 12, 1908).
3. Standard Specifications for Hydrants and Valves (adopted June 24, 1913; revised June 9, 1916).
A joint committee is now at work on revisions of these standards.
Other committees working on subjects of interest to architects and constructors are those on: Electrolysis, Standard Specifications for Wrought Iron Pipe, Plumbing Code and Control of Plumbers, City Planning, and Private Fire Protection Service.

9B3b *New England Water Works Association*

Secretary: Willard Kent, Narragansett Pier, R. I.

Publications:

1. Journal of the New England Water Works Association. Quarterly. Contains papers presented at the six regular meetings each year, with discussions, and list of officers and reports of committees.
2. Standard Specifications for Cast-Iron Pipe and Special Castings. (Adopted Sept. 10, 1902.)
3. Index. Lists articles, papers and other information contained in "The Transactions," from 1883 to 1885, and in the Journal from Volume I to date.

9B3c *Water Works Manufacturers' Association*

Secretary: E. K. Sorenson, 15 Broad Street, New York City.

Issues no publications.

9B4 *National Association of Master Plumbers of the U. S.* Organized 1883.

Secretary: A. A. Zertanna, 4337 Manchester Ave., St. Louis, Mo.

Publications:

- (a) Convention Proceedings, published annually.

Aims to establish harmonious and equitable relations between master plumbers, hydraulic and sanitary engineers, journeymen plumbers, and other employees, and manufacturers and jobbers in supplies used in plumbing, heating, gas-fitting and the drainage business; to educate apprentices in plumbing and to establish an apprenticeship system; and to promote the standardization of fittings and other plumbing goods.

This Association, together with the National Association of Master Steam and Hot Water Fitters, was represented in a joint conference in November, 1913, with the American Institute of Architects to consider the advisability of the direct letting of mechanical equipment contracts, which resulted in the adoption by the Institute of the resolution quoted under 9Ga.

9B5 *Cast Iron Soil Pipe Makers' Associations*

Eastern Soil Pipe Association

Secretary: Chas. F. Tuttle, 269 Clinton Ave., Brooklyn, N. Y.

Southern Soil Pipe Association.

Secretary: M. W. Bush, Birmingham, Ala.

Publications:

- (a) "Complete Specification for Cast-iron Soil Pipe and Fittings."
- (b) "A Nation-wide Comparison of House-drainage Piping."
- (c) "Cast-iron Soil Pipe vs. Wrought Pipe—for House-drainage."
- (d) Numerous reprinted technical papers pertaining to house-drainage piping.
Copies of any of the above will be sent upon application.

The chief object of these Associations is to standardize the manufacture of all extra heavy cast-iron soil pipe and fittings so that a single specification covers the product used by all consumers. These specifications are for adoption in Federal and municipal plumbing rules or regulations and cover in detail the weights of fittings as well as pipe, the quality of iron used in pipe, testing of pipe, marking, dimensions and radii of bends, hubs, etc. Another object of these Associations is to promote sanitation by the use of cast-iron soil pipe for all house-drainage, that is for house-sewers, house-drains, soil-stacks, vents, and leader lines.

9B6 *American Concrete Pipe Association*

Secretary-Treasurer: J. H. Libberton, 210 S. La Salle St., Chicago, Ill.

Publications:

- (a) Proceedings of Annual Conventions, containing papers and discussions on all phases of the manufacture, use, and application of cement sewer pipe and drain tile.

This organization is composed entirely of men who are interested in concrete sewer pipe, irrigation pipe, and drain tile, either as manufacturers of the pipe itself or as manufacturers of equipment for making such pipe.

The Association coöperates with the A.S.T.M. and other organizations in the formulation of standard specifications.

9B7 *The Sewer Pipe Manufacturers' Association*

Field Commissioner: John L. Rice, Second National Bank Building, Akron, Ohio.

Publications:

- (a) "Vitrified Clay Pipe." 32 pp., illus. Contains description of Salt Glazing, Results of Tests, and Specifications for Sewer Pipe and the Laying of Sewer Pipe.
- (b) "About Culverts." 32 pp., illus. Contains Basic Principles, Types, Definitions, Sizes, Costs, Diagrams and Culvert Design, the latter by P. K. Sheldner from Proceedings of Ohio Engineering Society.
- (c) "Clay Products for Building Construction." 32 pp., illus. Concerns Vitrified Clay Pipe for House Drains, Wall Copings, Flue Linings, and Fire Clay Chimney Tops, and contains Building Code Suggestions and diagrams from publications of the N.B.F.U. and the N.F.P.A.
- (d) The latter includes, "House Drain Specifications," approved by the Association, with illustrations of Vitrified Clay Sewer Pipe and Fittings.

This Association was formed for the purpose of promoting the welfare of the sewer pipe industry and to the end that the public might be more fully informed as to the adaptability of vitrified clay pipe and other clay products and as to the best manner of using them.

A committee is now working on the subject of standardized practice with respect to the manufacture and laying of sewer pipe.

9C1 Housing Associations and Other Volunteer Organizations Which Work for Improvement of Sanitation in Buildings

(Written for the Journal by John Ihlder)

The importance of good sanitary standards is becoming generally recognized, but the old easy distinction between what is necessary for me and what for the other fellow still makes necessary a great amount of educational work. In our progressive cities the operative builders find it so difficult to sell or rent new houses without sanitary toilets and even bathtubs, that they themselves often build the sewers.

This applies not only to expensive houses for the well-to-do, but, in some cases, even to the less expensive for the wage-earner. In cities where it is the policy for the municipality to pay all or a considerable proportion of the cost of sewer-extension out of general funds, as in Philadelphia, the builder of wage-earners' houses, who must work on the smallest possible margin, is between two influences. He cannot build sewers at his own expense entirely and yet compete with the builder on a city-sewered street; he cannot sell his houses unless he at least holds out a promise that they will have modern sanitary conveniences. This creates a strong demand for rapid sewer extension, but pending such extension he does all he can. For instance, I saw recently a group of three-bedroom brick houses on the far outskirts of southwestern Philadelphia, now nearing completion, which are to sell for \$2,600—a low price in these times. Each has a good-sized bathroom containing tub and basin and pipes for water-closet. The waste from tub, basin, and kitchen sink flows into a temporary wooden sewer that empties into a nearby creek. In the back yard is a temporary privy which will be replaced by a water-closet in the bathroom as soon as the Ward Business Men's Improvement Club—of which the builder is a very active member—can secure an extension of the city sewer system. Without these visible tokens of an imminent change at minimum expense the houses would not be salable.

This is in part a result of the work of housing associations and committees which for years have insisted that the well-being of the community demands as good sanitary conditions for the wage-earner's family as for families of those of a higher economic status. Not only has the wage-earner himself come to accept this, but public opinion has begun to support it also.

So the sanitary problem of the new house seems to be nearly settled with the acceptance of a sound public policy backed by the continued interest of those most directly concerned. But this very acceptance of a right policy for new houses makes more difficult the problem of the old house in the poorer districts of our large cities in the East. Here are large areas where houses were built long before modern sanitation began, before the modern water-closet had been invented, before the stationary bathtub had been thought of. In these houses the operative builder has considerably less than no interest—they compete with his new houses, and he is quite willing that they should not be made more attractive than their central location inevitably makes them. Moreover, where the city pays all or a considerable part of the cost of sewer extension, there is such competition for a share in the appropriations that these rarely suffice to go around. The owners of the old houses are frequently indifferent. To begin with, they often have a backward-looking instead of forward-looking habit of mind. Their houses never had sanitary conveniences. Frequently they are houses that once sheltered the city's aristocrats. What was good

enough for the former inhabitants certainly is good enough for the present ones. This habit of mind is buttressed by the fact that the houses, being centrally located, are usually easily rented so long as they are at all habitable. The immigrant is not particular. What he desires most is to live among his countrymen and to be near his work. Why then should the owner go to any expense to remodel and refit the old building? So in these old districts the housing workers and allied groups have a distinct and more difficult task since they are working for a population whose ignorance makes them comparatively indifferent and against, instead of with, a strong group who have financial interests in the properties. Yet even here they are making notable progress, backed though they are only by a slowly awakening public opinion and by a slowly increasing knowledge on the part of the inhabitants as to what unsanitary conditions mean to them personally.

In some of the smaller cities, even in the East, there are practically no houses without sewer-connected sanitary conveniences, as in Savannah, Ga., and Mt. Vernon, N. Y. Washington has reached almost as high a standing. In New York City practically all the tenement houses are equipped with sanitary water-closets, and an increasing proportion have bathtubs. In Baltimore, where a new sewer system and disposal plant have recently been completed, it is proposed to require that every dwelling in the city shall be sewer-connected, and it is already required that every new house containing four or more rooms shall have a bathtub with all necessary supply and waste pipes.

Even in Philadelphia, where past neglect has permitted the development of very unsanitary conditions, there has been notable progress in recent years. According to the official figures more than 8,000 privy vaults are being abandoned annually and sanitary water-closets installed in their places. Were it not for the building of new vaults on unsewered streets, Philadelphia might look forward with confidence to the end of this menace within a few years, despite the opposition of some owners and the slowness of sewer construction in the oldest districts. In these districts there are still approximately 30 miles of unsewered streets. Illustration of the worst of them is a dead-end segment of Spring Street near the Delaware River. Spring Street at this point is only about 12 feet wide. Opening off it is a court where stands an old house on the site occupied by Benjamin Franklin's home in 1748. The houses here are packed so closely together that in one place it has been necessary to make a two-story privy to provide for four houses. The Bureau of Surveys does not wish to put such dead-end streets on the city plan because they should not be perpetuated. Unless a street is on the city plan, sewer extension can not be compelled. Some of the owners—among them resident owners—do not wish the expense of sewer extension and connections. The city has not the power and there is as yet no public opinion in favor of clearing and replanning such an area.

It is with such complicated situations as this that housing workers in the older cities are compelled to deal. Considered individually such situations are almost hopeless; only the slow and uncertain extension of business and industrial areas can wipe them out. But we are getting beyond the individual situation to the development of city-wide policies in city planning and rebuilding. In that lies our main hope and to that we are led by our desire to improve the sanitation of the individual house. Plumbing

has wide ramifications. The well-to-do recognize its importance for themselves. The more ambitious of the wage-earners are willing to sacrifice time and carfare to secure it for themselves. Public opinion recognizes its desirability in a general way but has not yet become convinced of its necessity for the immigrant and the unskilled laborer.

To show this necessity is one of the tasks of housing associations and committees. New York, because it first developed intolerable conditions, was the first to make serious efforts for their reformation. It has had housing, or tenement house, committees for many years. The present committees of the Charity Organization Society and of the Brooklyn Bureau of Charities are very active organizations, and to the former New York owes its present tenement house law, enacted in 1901. Philadelphia, Boston, Pittsburgh, Washington, Chicago, and other large cities long ago organized committees or conferences to work for better sanitation and housing. The first of these had their inception among people interested primarily in social work among the poor, for to them came first-hand knowledge. But of late years chambers of commerce and other organizations have taken up the work because of its direct effect upon the continued prosperity of the community. Philadelphia was the first city to establish an independent housing association which should deal with all phases of the question and coordinate the work of all other agencies so far as they touch housing. This the Association's independent position has enabled it to do much more effectively than could a committee of an organization having other interests. There are now nearly seventy agencies in Philadelphia cooperating with the Housing Association by reporting to it the unsanitary conditions they find in the course of their work. Among these are hospitals, social settlements, local improvement societies, and such business organizations as the Chamber of Commerce.

The organization of the Philadelphia Housing Association in September, 1909, preceded by a few months that of the National Housing Association, which has had a great influence in stimulating interest throughout the country. Its annual conferences have been of great educational value. Largely as a result of its work there are now more than a hundred cities in which there are active organizations. Most of these are committees of charity organization societies, chambers of commerce, city clubs, or improvement associations. But several cities are progressing beyond this stage to that of the independent association which can devote all its energies to housing and can more effectively coordinate the housing work of other agencies. Among these are Chicago, Cincinnati, and Pittsburgh. There are several state organizations, like the Pennsylvania Housing and Town Planning Association, the Indiana Housing Association, and the New Jersey Housing Association, besides committees of such state organizations as the Massachusetts Civic League. These hold annual conferences. Even in the national field housing has been recognized by the National Conference on City Planning (now the City Planning Institute) and by the National Real Estate Association, which has a housing committee.

In addition, there are in a number of cities housing companies that build and manage improved wage-earners' dwellings on a limited dividend basis. Some of the earliest of these, as is so often the case in first attempts, have ceased operations or have failed to live up to their promise. The oldest that has enjoyed continuous success is the Octavia Hill Association in Philadelphia, founded in 1896 and still growing. The Housing Association owes its being to the Octavia Hill Association, whose officers were its founders.

Other conspicuous companies of this character are the City and Suburban Homes Company in New York City, the Sanitary Housing Company and the Sanitary Improvement Company in Washington, D. C., the Model Homes Company in Cincinnati, Ohio, the Woodlawn Company in Wilmington, Del., and the Improved Dwellings Company, in Brooklyn, N. Y. (See the pamphlet referred to under 9L39 which lists these companies, village improvement associations, and others.)

In all these developments the installation of sanitary conveniences is a conspicuous feature, as is evidenced in the names of some. While the later companies do not lay the emphasis upon sanitation that the older ones did, this means not that sanitation is considered less important, but that it has become so generally understood as not to require emphasis. The greatest single motive for this work, as in that of the increasing number of industrial villages now being built by the large corporations, is to provide sanitary dwellings for the wage-earner.

The increasing interest in this question is shown by the growing number of reports describing conditions in our cities. Illustrative of them are the reports published under the auspices of the Russel Sage Foundation on Springfield, Ill., Topeka, Kan., and Ithaca, N. Y., dealing with public health and with housing, and such independent reports as those on housing in Providence, R. I., Grand Rapids, Mich., Minneapolis, Cleveland, which concern themselves largely with sanitary conditions and methods for their improvement.—JOHN IHLDER.

[EDITOR'S NOTE.—In certain reports which will be found mentioned under the various subdivisions, particularly under 9L, references are made to the subject of sanitation and public health and to constructional work in connection therewith. Among these are: The Annual Reports of the Director General of the International Health Commission to the President of the Rockefeller Foundation; the Annual Reports of the Department of Engineering, City of Hartford, Conn., and others.]

9C2 Other Allied Interests and Influences

The American Ceramic Society, mentioned under 3C1, is an important factor in the development of porcelain and vitreous ware used in plumbing, in addition to which there are many state or local clay working associations which hold meetings and conventions.

There is record of the National Organization of Health Officials and also of the Confederated Supply Association,* the latter representing the various associations of plumbing supply dealers, both of which are referred to under 9Gb.

There is also record of the Enameled Sanitary Ware Manufacturers' Association, concerning which no information has yet been obtained.

There is also the American Institute of Metals and the National Association of Brass Manufacturers and others which are interested in metal plumbing accessories. These will be described later under Metal Products.

For description of the Range Boiler Exchange see 9F1.

There are, of course, "labor organizations" of the artisans, mechanics, and others employed upon the various branches of the work embraced within a plumbing installation, an activity of one of which is referred to under 9K1.

*For some publications of C.S.A., see 9L48.

9C3 Educational and Research Work

In the colleges, technical and other institutions of the country instruction in hydraulics and sanitation is being cared for. A list of many of such, including those where branches of the A.S.M.E. are located, was given under 1B3a.

A practical indication of interest from without was manifested when recently awards were made of the Nelson Prizes in Plumbing. These were presented through the

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courtesy of the Cast Iron Soil Pipe Makers Advertising Association for the best papers on the "Practice or Theory of Plumbing" prepared by any student or instructor in Harvard University or the Massachusetts Institute of Technology, or by any student or instructor in other institutions of learning who had had training in the theory or practice of house-drainage. The Chairman of the Committee in charge of the awards was George C. Whipple, Professor of Sanitary Engineering, Harvard University, and the prizes were named for N. O. Nelson, a manufacturer of plumbing supplies who has devoted himself to the general improvement of living conditions.

First prize of \$100 was awarded to Thomas J. Claffy,

Assistant Chief Sanitary Inspector, Health Department, Chicago, Ill., for a paper entitled "Plumbing." Second prize of \$50 to James W. Anderson, student graduating in the class of 1917 from the Massachusetts Institute of Technology, Cambridge, Mass., for paper entitled "A Study of the Different Types of Pipes Used in the Disposal of Rain Water from Buildings." Third prize of \$50 to Walter G. Ward, Instructor, North Dakota Agricultural College, Agricultural College, N. D., for a paper entitled "Water Closet Connections."

A new contest similar to the one just completed, but involving awards approximating \$750, is planned for the ensuing year.

9D Water Supply, Storage, Utilization and Incoming Pipes (See, also, 9M and 12H)

Many publications are issued dealing with investigations and developments in connection with hydraulics, public water supplies, reservoirs, standpipes, pumping equipment, and other phases of this subject. These are also treated in the leading pocket-books, handbooks, and other literature prepared for the use of architects, engineers, and constructionists. Independent private water supplies will usually be found treated in the publications of the manufacturers which specialize in their production and installation. Much attention has been given to the development of standards in the manufacture of water pipes by associations and societies whose activities are elsewhere referred to and the results of which are listed under this heading and under those subdivisions which follow pertaining to water. The subject of trenching for and laying of pipes has been carefully studied, the interest in which is confined not alone to water or incoming pipes but to drains or outgoing pipes. In other ways the subjects of water-supply and drainage are interlaced and so closely related to the public health that the references under 9L which treat of outgoing pipes should also be consulted.

For Tanks, Reservoirs, and Tank Supports, being Regulations and Standards pertaining to these subjects, see April Journal 4D5.

1. The U. S. Geological Survey (2A14) has published about 400 reports on various phases of water-supply and conditions likely to be met with in different parts of the country.
2. The U. S. Bureau of Mines (2A3) has issued:
 - (a) Technical Paper 33, "Sanitation at Mining Villages in the Birmingham District, Ala." (9L1a), contains a section on "Water Supply."
 - (b) Bulletin 87, "Houses for Mining Towns" (9L1c), contains sections on "Responsibility for Water Supply" and "Sources of Water Supply."
3. The U. S. Reclamation Service issues:
 - (a) "List of Publications," No. 3, 1916. In same will be found many references to reports and bulletins on water supplies, farm plats, and town sites, including maps, specifications and drawings which may be had upon application to Arthur P. Davis, Director and Chief Engineer, 2212 First St., Washington, D. C., or the Superintendent of Documents, Government Printing Office, Washington, D. C.
 - (b) "The Reclamation Record," a regular bulletin of service, issued monthly and contains many illustrated articles. Subscription 50 cents per year.
4. Read the "Indexes to Transactions and Proceedings" and other publications of the American Water Works Association, The N. E. Water Works Association, and others described under 9B for references to complete libraries of information on the subject, not alone of water, but of all appurtenances and allied subjects.
5. See "Review of Current Technical Literature" and *Journal* of the A.S.M.E. for information on all phases of this subject. Also reports of committees in that Society on Filter Standardization. See, also, Standards recommended in reports of committees received by the Council of the A.S.M.E. (Serial No. 10.) as follows:
 - (a) Special Reports on Standard Pipe, Pipe Threads, and Pipe Unions.

- (b) Separate Reports on Standard Threads for Hose Couplings, Standard of Pipe Thread Gages, and Standard Thickness Gage for Metals.
- (c) The American Standard for Pipe Flanges, Fittings, and Bolting.
6. See "Proceedings" of the A.S.C.E. for lists of "Current Engineering Literature," on matters connected with water-supply. Also reports of the committee in that Society on "A National Water Law."
7. "Reservoirs," by James Dix Schuyler, 573 pp., illus., contains sections on Domestic Water Supply, Types of Dams, and the Methods, Plans, and Cost of Their Construction; also Distribution, Application, and Use of Water and the Rainfall and Run-off from various Watersheds.
8. "Water-Supply Engineering," A. Prescott Folwell. 570 pp., illus. Included in the Contents are: Sources of Supply, Gravity Systems, Pumping Systems, Hydraulics, Dams and Embankments, Pumping and Pumping Engines, Practical Construction, Pumping-plants and Filters, Pipes and Conduits.
9. "Waterworks Handbook," by A. D. Flinn, R. S. Weston, and C. L. Bogert. 824 pp., illus., 311 tables. Contents include: Dams, Wells, Equipment for Treating Water, Aqueducts, Pipes, Pumps, Pumping Stations and Equipment, Standpipes and Tanks, Non-ferrous Metals (also corrosion of iron and steel).
10. "Towers and Tanks for Water Works," J. N. Hazelhurst. 325 pp., illus.
11. "Water Works for Small Cities and Towns," John Goodell. 286 pp., illus. Contents include: Dams, The Utilization of Springs, Open Wells, Driven Wells, Deep and Artesian Wells, Pumps, The Air Lift, Pumping Stations, Pipes, and The Quantity of Water to Be Provided.
12. "Waterworks Distribution," J. A. McPherson. 175 pp., illus. A practical guide to the laying out of systems of distributing mains for the supply of water to cities and towns.
13. "Small Water Supplies," F. N. Taylor. 180 pp., illus. A practical treatise on the methods of collecting, storing, and conveying water for domestic use in country estates, small villages, and farms. Contents include: Wells and Well-sinking, Noises in Water Pipes and Their Causes.
14. "American Civil Engineers' Pocket Book," (9G22), Mansfield Merriman, pp. 914-927: Section on "Collection of Water."
15. "Elements of Sanitary Engineering," (9L15), Mansfield Merriman, contains information on "Water Supply Systems" and "New Water Supply for New York City."
16. "Clean Water and How to Get It," (9E1), Allen Hazen, treats of water-supply from various sources.
17. "Water Purification and Sewage Disposal," J. Tillmans. Translated by Hugh S. Taylor. 169 pp., illus. A critical survey of the work of German authorities in developing modern methods for suitable water-supplies and the adequate disposal of sewage.
18. "Treatise on Hydraulics," Mansfield Merriman. 565 pp., illus. Contents include, besides all Fundamental Data: Water Supply and Water Power, Water Wheels, Turbines, Pumps and Pumping.
19. "Treatise on Hydraulics," Henry T. Bovey. 582 pp. Contents include descriptions and illustrations of Rams, Presses, Accumulators, Water-pressure Engines, Vertical Water-Wheels, Turbines and Centrifugal Pumps.
20. "Water Power Engineering," D. W. Mead, 843 pp., illus. Covers the theory, investigation, and development of water power and presents fully the details of the entire engineering problem from the first investigation to the complete plant.
21. "Mechanical Equipment of Federal Buildings," Chapter IV (9G1—), contains a section on Water Supply, with information as to service installations and data on sizes and kinds of service pipes and branch water-supply pipes. See, also, p. 384 of this book for Table of Capacity of Cylindrical Tanks.

22. See "Sanitation of Public Buildings" (9G4), Wm. Paul Gerhard, for sections relating to water-supply and utilization.
23. See "Water Supply, Sewerage, and Plumbing of Modern City Buildings" (9G5), by Wm. Paul Gerhard, for information on Domestic Water Supply, The Water Supply of Large Modern Buildings, and other data.
24. See Chapter IX on Water Supply Systems in "Mechanical Equipment of School Buildings" (9G8), H. L. Alt.
25. "The Sanitation, Water Supply and Sewage Disposal of Country Houses" (9G7), Wm. Paul Gerhard, dwells upon the sources of water, various modes of raising and storing water and its distribution, and gives detailed advice on how to obtain a satisfactory water-supply.
26. See "Architects' & Builders' Pocket Book" (9G9), F. E. Kidder, for information on Private Water Supply Pumps, Construction of Cylindrical Wooden Tanks, Capacity of Tanks, Windmills, Fire Streams.
27. "Domestic Sanitation and Plumbing" (9G13), A. H. Shaw, contains water supply information in Part II.
28. "Sanitary Plumbing and Drainage" (9G12), J. W. Hart, contains a section on water supply.
29. See *Journal of the Society of Constructors of Federal Buildings*, November, 1915, pp. 336-338, for Paper No. 196, entitled "An Experience with House Water Supply Piping," by Harry G. Richey.
30. See "I.C.S. Plumbers' and Fitters' Handbook" (8G23), section on "Water Supply and Distribution" for information on 'Sizes of Street Service Pipes Suction Lifts, Sizes of Wooden Tanks, Size of Water Pipes in Building, and Air Locks in Water Pipes.
31. For Tables of Capacity of Rectangular Tanks, Cylindrical Tanks, Cisterns, etc., see "I.C.S. Building Trades' Handbooks," pp. 399, 400.
32. "Hydraulic Tables," Gardener S. Williams and Allen Hazen. 104 pp. Included in the contents are: Observations of Flow in Cast-iron, Riveted Steel, Wooden-Stave, Rectangular Wooden, Cement, Wrought-iron, Galvanized-iron, Brass, Lead, and Glass Pipe, Fire-hose, Open Conduits, Aqueducts, Brick Sewers, and Canals.
33. "Flow of Water," L. Schmeer. 134 pp., illus. A new theory on the motion of water under pressure and in open conduits, and its industrial application.
34. "Water Pipe and Sewer Discharge Diagrams" (with tables and charts), T. C. Ekin. These give the discharges in cubic feet per minute of every inch diameter of pipe from 3 to 48 inches. Velocity curves are shown on the diagrams.
35. "Crosby-Fiske Handbook of Fire Protection" contains tables on the Flow of Water in Pipes, Capacity of Full Smooth Pipes, Friction of Water in Pipes, Capacity of Wrought Iron Pipe.
36. "Water Hammer in Hydraulic Pipe Lines," A. H. Gibson. 68 pp. illus.
37. For "Water Pipe Calculations" see "Lefax" Data Sheet -5, by J. W. Ledoux.
38. See "The Hydraulic Ram," "Lefax" Data Sheet 7-83. 4 pp. compiled by T. M. Lane, with diagrams.
39. For "Windmills," see "Mechanical Engineers' Pocket Book," William Kent, 1916, pp. 627-632. Gives information on Power and Efficiency, Capacity and Economy of the Windmill, with tables.
40. For "Windmills," see "Mechanical Engineers' Handbook," Lionel S. Marks, 1916, pp. 864-865. Gives two tables and important references on the subject.
41. For "Water Wheels," see "Mechanical Engineers' Handbook," Lionel S. Marks, 1916, pp. 1070-1071. Contains diagrammatic illustrations.
42. N.F.P.A. "Index" (3A345) contains references to information on Cast Iron Coated Water Pipes and Cast Iron Water Mains.
43. The Associated Factory Mutual Fire Insurance Companies have issued: "Laying Cast Iron Water Pipes in Factory Yards—Rules" (3A7a17).
44. The New England Water Works Association issues:
(a) Standard Specifications for Cast-Iron Pipe and Special Castings (9B342). Adopted September 10, 1902. (See 46 below.)
45. The American Water Works Association issues the following:
(a) Standard Specifications for Cast Iron Water Pipe and Special Castings (9B342), adopted May 12, 1908.
(b) Standard Specifications for Hydrants and Valves (9B343), adopted June 24, 1913; revised June 9, 1916. (See 46 below.)
46. NOTE.—Committees of the two Water Works Associations and of the Manufacturers' Association have been working for some time in the endeavor to harmonize the differences between the standard specifications above referred to.
47. The Standard Specifications for cast iron pipe and special castings (Serial Designation A44-04) of the A.S.T.M. were adopted November 15, 1904, and therefore antedate those of the American Water Works Association.
These two Standard Specifications, while entirely independent, are identical for practical purposes, for while the highpressure pipe feature of the A.W.W.A. specifications is of interest to water works officers generally, only the larger communities install such systems.
The whole question of Standard Specifications for water pipe and fittings is closely connected with world trade, and hence the export feature is bound to come to the front more and more. Even the present specifications, nearly identical as they are, should be considered only as fundamental to the international specifications of the future. A very considerable step has been taken in this direction by the International Association for Testing Materials, which has before it at the present time a proposed standard for export use—each pipe-making country of the world retaining its own specifications but all uniting on the international proposal, if found acceptable and workable, for the good of international trade relations.

9E Filtration and Water Treatments

The subject of water purification is covered in the foregoing principal division but the following are listed separately for their special interest in this connection.

1. "Clean Water and How to Get It," Allen Hazen. 196 pp., illus. Treats of: The Action of Water on Iron Pipes and the Effect Thereof on the Quality of Water, Red-water Troubles, Development of Water Purification in America, Storage of Filtered Water, The Required Sizes of Filters and Other Parts of Water Works, Measurement of Water.
2. "Value of Pure Water," Geo. C. Whipple. 84 pp. Included in the Contents are: Benefits of Filtration, Water-softening, Cost of Filtration, The Disadvantages of Hard Water, Use of Hard Water in the Household, in the Industries, and in Steam Making, Financial Loss from the Use of Hard Boiler Water.
3. "Waterworks Handbook" (9D9), A. D. Flinn, contains information on Equipment for Treating Water, Water Softening, and Filtration.
4. "Elements of Sanitary Engineering" (9L15), M. Merriman, contains information on Water and Its Purification, Water Filtration at Philadelphia, and Water Filtration at Little Falls, N. J.
5. "Water Works for Small Cities and Towns" (9D11), John Goodell, contains a section on "Clarification and Purification of Water."
6. "American Civil Engineers' Pocket Book" (9G22), Mansfield Merriman, pp. 927-942: Section on "Purification of Water" treats of Auxiliary Methods, Sedimentation, Sand for Filters, Sand Ejectors, Mechanical Filters, and Results of Filtration.

9F Heating and Cooling of Water

The same note as made under 9E as to these subjects being also covered in the main division 9D applies here. The heating of water by gas was fully treated in the July Journal under subdivision 7K.

See, also, 9M and 12H)

7. See "I.C.S. Plumbers' and Fitters' Handbook," section on "Water Supply and Distribution" (9D30) for information on water Filtration.
8. See "Mechanical Engineers' Pocket Book," 1916, Wm. Kent, for section on "Purifying Feed-Water for Steam Boilers," pp. 723, 724.
9. See "Architects' & Builders' Pocket Book" (9G9), F. E. Kidder, for brief information on Filters and Softening Hard Water for Domestic Use.
10. See Adopted Report of Committee on Water Service, published in Manual of the American Railway Engineering Association (1A9c), pp. 443-464, for
(a) Quality of water, methods of treatment, and results obtained therefrom.
(b) Efficiency of water-softeners.
(c) General principles of water-supply service.
(d) General specification for steel water and oil tanks (requiring plates not more than $\frac{5}{8}$ inch thick).
11. See reference to the Report of Committee on Filter Standardization A.S.M.E. under 9D5.
12. See "Water Purification and Sewage Disposal," J. Tillmans, described under 9D17.
13. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see the following pages in the Industrial Section:
(a) "Clean, safe, freshly filtered Water," Loomis-Manning Filter Distributing Co., p. 216.

The cooling of water applies chiefly to drinking-water systems which are herein referred to independently of the general subject of refrigeration, with which it is closely

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connected and which will be referred to under a separate heading in the October Journal, Serial No. 10.

1. "Mechanical Equipment of Federal Buildings," Chapter IV (9G1), contains a division on "Refrigeration," which treats of Systems, Cooling Tanks, Cooling Coils, Circulating Pump, Circulating Lines, Drinking-Water Fountains and Faucets, Methods of Calculation, and Amount of Water Circulated. In addition to various tables, an example of the actual figures used in estimating a plant in one of the larger buildings is given. Included in the above Chapter is a typical Specification for a Drinking-Water System, which is the uniform type used by the Supervising Architect's office.
2. In "Mechanical Equipment of Federal Buildings," pp. 134, 135, is information on Exhaust and Live Steam Heaters for heating of water, and on pp. 159-161 are data on heating of water by gas and by coal for storage and circulating systems with calculations for the number of outlets and fixtures.
3. "Inexpensive Plumbing for Farm Kitchens," W. E. Etherton, Professor of Rural Architecture, Extension Bulletin No. 9, April, 1916, Kansas State Agricultural College. 23 pp. Describes and illustrates a unique arrangement for securing hot and cold water from a kitchen range boiler with the use of a hand-pump at the fixture.
4. "Hot Water Circulation," R. M. Starbuck. Illus. A set of 50 blue-prints showing range boiler connections and hot-water circulation put in under all possible conditions. Full notes and suggestions accompany each print.
5. See "Architects' & Builders' Pocket Book" (9G9), F. E. Kidder, for information on Instantaneous Water-Heaters, An Automatic Water Heater, and Heating Water with Steam Coils. Also, see section on "Mechanical Refrigeration" for information on Water and Milk Cooling.
6. See Hutton's "Hot Water Supply and Kitchen Boiler Connections," 211 pp., illus.
7. See Starbuck's "Range Boiler-work, Hot Water Supply, etc.," Vol. II, 160 pp.
8. "Domestic Sanitation and Plumbing" (9L30), A. H. Shaw. Part II, contains information on Domestic Hot-Water Service.
9. See Chapters X and XII on "Hot Water Systems" and "Drinking Water" in "Mechanical Equipment of School Buildings" (9G8), H. L. Alt.
10. See "I.C.S. Plumbers' and Fitters' Handbook," section on "Water Supply and Distribution" (9D30), for table and data on Heat Transmission through Metals to Water, for Standard Sizes of Galvanized Boilers and for Size and Capacity of Hot-Water Supply Tanks.
11. See reference to water heaters and mixers in Technical Paper "Miners Wash and Change Houses" (9J16).
12. See "A Method for Practical Elimination of Corrosion in Hot

Water Supply Pipe," paper by F. N. Speller. 1916. 12 pp. Reprinted from the *Journal of the American Society of Heating and Ventilating Engineers*.

13. The U. S. Department of Agriculture has issued Farmers' Bulletin No. 475, "Ice Houses," by L. C. Corbett. 1917. 20 pp. Contains construction diagrams and other illustrations.
14. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see the following pages in the Industrial Section:
 - (a) Heating of Water by Automatic Gas Water Heater, Humphrey Company, p. xv.
 - (b) Removal of Discoloration from Hot Water, Loomis-Manning Filter Distributing Co., p. xviii.

9F1 Standardization of Range Boilers and Others

While the Code of the A.S.M.E. (referred to under Serial No. 10) for the "Construction of Steam Boilers and Other Pressure Vessels and for Their Care in Service" covers the manufacture of steel-plate hot-water boilers over 60 inches in diameter, or where the grate area exceeds 10 square feet and the maximum allowable working pressure exceeds 50 pounds per square inch, there appears to be a noticeable lack of uniformity in the gauge of metal and sizes of boilers manufactured for domestic purposes or use in small installations.

The words "standard" and "heavy" are used extensively though the resultant products seem to vary according to various manufacturers' interpretations of these terms.

Realizing the great need of standardization in the range boiler industry in respect to capacities, dimensions, and guarantees, nine manufacturers organized The Range Boiler Exchange, with A. A. Ainsworth, Secretary, 17 Battery Place, New York City, and on March 14, 1916, issued a pamphlet, "Regulations Governing the Sale and Installation of Range Boilers as Adopted by The Range Boiler Exchange." This gives a list of sizes, capacities, and approximate prices of range boilers and expansion tanks, describes standard tappings and guarantees, and gives recommendations for the successful and economical installation of range boilers and expansion tanks.

The State of Massachusetts adopted, as revised to take effect July 2, 1916, Senate Bill No. 395 relative to the capacity, working pressure, and manufacture of range boilers, requiring that all vessels or tanks in which water is to be heated under pressure in the Commonwealth is to have stamped thereon its capacity, the maker's name and guarantee that it has been tested to not less than 200 pounds' pressure to the square inch.

Notwithstanding the above, there is room for improvement in the matter of standardization, so that range boilers, expansion tanks, storage, pneumatic, and other tanks, may be specified with an exactness that will secure equable conditions in estimating and the installation of the article intended.

9C Plumbing Installations in General (See, also, 9M)

Under this heading will be placed those reference works and other publications which cover the whole subject fully. For convenience many of them, or sections from them, will be found mentioned also under the various subdivisions wherever the references are especially applicable or significant.

The subject of Piping Buildings for Gas, usually associated with plumbing installations, was treated under Serial No. 7 in the July issue of the Journal.

1. "Mechanical Equipment of Federal Buildings" (6L1), pp. 137-193. Chapter IV on "Plumbing, Drainage, and Water Supply" contains much valuable data and many tables and recommendations for plumbing installations, also a Report of Committee on Toilet Regulations for Industrial Plants (9H5). It also contains several pages of very complete "Itemized Estimating Data" for fixtures, fittings, piping and all features of a plumbing installation.
2. "Mechanical Equipment of Federal Buildings," Chapter IV, also contains a section on "Tests of Plumbing and Drainage System," which treats of Water, Air, and Smoke Tests, Test of Water-Supply System, Cost of Tests, and Certificate.
3. In "Mechanical Equipment of Federal Buildings" will also be found the following information: p. 383, Table of Standard Dimensions of Wrought Iron and Steel, Steam, Gas and Water Pipe; p. 388, Table giving Velocity of flow of water in feet per minute, through pipes of various sizes, for Varying Quantities of Flow; p. 389, Table giving Loss in Pressure Due to Friction in Pounds, per Square Inch, for Pipe 100 Feet Long; p. 392, Table of Pressure in Inches of Water; p. 392, Table of Pressure in Ounces per Square Inch, and, p. 397, Table of Weights of Galvanized Iron Pipe per Lineal Foot.
4. "Sanitation of Public Buildings," Wm. Paul Gerhard. 262 pp.

Part I deals with Hospital Sanitation including: Disinfecting Station, Garbage Disposal, Bibliography.

Part II: Theater Sanitation, Ventilation, Lighting, Bibliography.

Part III: Church Sanitation, Precautions against Fire and Panic, Seating, Dust, Lighting, Heating, Ventilation, Plumbing, Bibliography.

Part IV: School Sanitation—Heating and Ventilation, Lighting, Fire Protection, Sanitary Arrangements, School Baths, Bibliography.

Part V: Sanitation of Markets and Abattoirs—Interior features, Equipment, Ventilation, Lighting, Removal of Waste Food, Sanitary Features, Mechanical Equipment, Bibliography, Appendices.

5. "Water Supply, Sewerage, and Plumbing of Modern City Buildings," Wm. Paul Gerhard. 491 pp., illus. Contents include: The Essential Features of the Hydraulic and Sanitary Engineering of Buildings; The Maintenance of Pipe Systems for Sewage, Gas, and Water; Rules on Plumbing, Water Supply, and Sewerage of Hospitals and other Public Institutions; Definitions; and Plumbing Specifications Reminder.
6. "Sanitary Engineering of Buildings," Wm. Paul Gerhard. Illus. I. Defective Plumbing and Sewer Gas. II. Traps and Systems of Trapping. III. Sewerage of Buildings. IV. Plumbing Fixtures. V. Sewage Removal and Sewage Disposal. VI. The Leading Principles of House Drainage and Sanitary Plumbing. VII. Improved Methods of House Drainage. VIII. The Proper Arrangement of Water-Closet and Bath Apartments. IX. A Plea for Sanitation in Factories and Workshops. X. The Sanitary Drainage of Tenement Houses. XI. On Testing House Drains and Plumbing Work. XII. Simplified Plumbing Methods.
7. "The Sanitation, Water Supply and Sewage Disposal of Country Houses," Wm. Paul Gerhard. 348 pp., illus. General sanitation of country houses, relation of the soil, subsoil, surface drainage, aspect, surroundings, lighting, heating, ventilation, water-supply, sewage, etc., to a healthful home.

8. "Mechanical Equipment of School Buildings," Harold L. Alt. 112 pp., illus. Contains Chapters as follows (other Chapters referred to elsewhere): V. Toilet Fixtures. VI. Plumbing Fixtures. VII. Number and Location of Fixtures. VIII. Toilet Partitions and Shower-Baths. IX. Water-Supply Systems. X. Hot-Water Systems. XI. Fire Protection. XII. Drinking Water. XIII. Sewage Disposal.
9. See "Architects' & Builders' Pocket Book," 1916, F. E. Kidder. Contains a section on "Hydraulics, Plumbing and Drainage, Gas and Gas-Piping" (pp. 1295-1350), by J. J. Cosgrove, which treats of Hydraulics, Private Water Supply, Pumps, Windmills, Fire-Streams, Construction of Cylindrical Wooden Tanks, Capacity of Tanks, Plumbing Definitions and Requirements, Plumbing Materials and Details, Testing of Plumbing Systems, Plumbing Specialties, Symbols for Plumbing. Includes numerous tables and diagrams.
10. "How to Drain a House," G. E. Waring. 229 pp. Third edition enlarged. Illus. Contains practical information for householders on Drains, Foundation and Cellar, Sewer Gas, Fresh Air Inlets, Soil Pipe, Traps and trap Ventilation, Plumbing Appliances, and Sewage Disposal.
11. "Modern Sanitary Engineering," Thomson Gilbert. 283 pp., illus. Part I: "House Drainage." Contents include considerations of the Site and Surroundings of the House, General Principles of Drainage Design, Materials and Size of Drains; Traps—Their Principle, Efficacy, Number, Position and Ventilation, Fixtures and Fittings, Designing a System of Drainage, Buildings of Special Class, Sewage Disposal for Isolated Houses.
12. "Sanitary Plumbing and Drainage," J. W. Hart. 253 pp., illus. Contents include: Sanitary Surveys, Sanitary Defects, Water Supply, Town House Sanitary Arrangements.
13. "Domestic Sanitation and Plumbing," in two parts, A. Herring-Shaw. Part I: Materials and Their Uses. 334 pp. illus. Part II: Water Supply, Domestic Hot-Water Services, Warming and Ventilation of Buildings. 374 pp., illus.
14. "Standard Practical Plumbing" Vols. I and II, J. P. Davies. A complete encyclopædia for practical plumbers and guide for architects, builders, gas-fitters, hot-water fitters, sanitary engineers, and others. Contains numerous engravings.
15. "The Building Foreman's Pocket Book and Ready Reference," H. G. Richey, 1118 pp., illus. Contents include data on Boilers, Water, Sewers, Soil and Vent Pipes, and miscellaneous plumbing information.
16. "A Handbook for Superintendents of Construction, Architects, Builders and Building Inspectors," H. G. Richey.
17. "The Mechanics' Ready Reference," H. G. Richey. Prepared for each trade.
18. "The New Building Estimator," William Arthur. 1913. Part II contains a section on "Plumbing and Gas Fitting."
19. "Plumbing Practice" Vol. 1, J. W. Clarke and Walter. 297 pp., illus. Practical lead-working and plumbers' materials described.
20. "Mechanical Engineers' Handbook," 1916, Lionel S. Marks. Section on "Pipe and Pipe Fittings," pp. 790-842, contain information on Cast-Iron, Wrought-Iron, and Steel Pipe; Pipes and Tubes of Copper, Brass, Lead, Tin and Aluminum; Vitrified, Wooden-Stave and Concrete Pipe; Fittings for Wrought-Iron and Steel Pipe; Valves; Pipe Supports; Pipe Coverings; numerous diagrammatic illustrations and tables of sizes and weights.
21. See "Civil Engineers' Pocket Book," 1913, J. C. Trautwine, pp. 649-688. Contains sections on Consumption, Use and Waste, Reservoirs, Service Pipes, Anti-bursting Device, and Fire Hydrants. Also contains section on "Water Pipes," which treats of Prevention of Concretions in Water Pipes, Gives Weights of Cast and Wrought Iron Pipes, Wooden and Other Pipes, Costs of Pipes and Laying, Repairs and Connections.
22. See "American Civil Engineers' Pocket Book," 1916, Mansfield Merriman, pp. 913-1022. Also (pp. 395-397), contains tables of Standard Pipe, Standard Pipe Fittings, Flanges.
23. See "I.C.S. Plumbers' and Fitters' Handbook," section on "House-Drainage System," which gives Drainage System Details; Least Sizes of Soil, Waste, and Vent Pipes; Sizes of Traps and Back Vents and data on Testing Plumbing by Water, Air and Smoke. Also see pp. 261-375, for Plumbing Materials and Fixtures, Drainage and Sewerage, Water Supply and Distribution, and other useful information for plumbers and others.
24. See "I.C.S. Building Trades Handbook," section on "Plumbing."
25. See "I.C.S. Mechanics' Handbook" for information on Sizes and Weights of Pipe, Standard Dimensions, and Cylinders.
26. The above I.C.S. handbooks are independent of two volumes on "Refrigeration" and two volumes on "Plumbing and Gas-Fitting" in the extensive International Library of Technology, each of which treats the subject exhaustively.
27. See Gray's "Plumbing, Design and Installation" 560 pp., illus.
28. See Hutton's "Country Plumbing Practice," 310 pp., illus.
29. See "Standard Practical Plumbing," R. M. Starbuck.
30. "American Sanitary Plumbing," J. J. Lawler. 320 pp., illus. For plumbers, steam fitters, architects, builders, apprentices and householders.
31. "Sanitary House Drainage: Its Principles and Practice," H. Coleman, 186 pp. A manual for architects.
32. "Treatise on Water Supply, Drainage and Sanitary Appliances of Residences," F. Colyer. 92 pp.
33. For papers and lectures in connection with materials, methods, and devices used in plumbing installations, see the Index to the Library of the Franklin Institute, of the state of Pennsylvania.
34. See Index to "Lefax Data Sheets," classification (1) Civil, and (2) Mechanical, for topics of interest.
35. "External Plumbing Work, J. W. Hart. Second edition. 280 pp., illus. A treatise on leadwork for roofs.
36. See "A Plea for Strict Plumbing Codes" by Dr. Wm. Paul Gerhard. Reprinted by courtesy of *The Sanitary Engineer* of Toronto in "Sanitary Pottery" for July and August, 1917.
37. The U. S. Department of Agriculture Office of Experiment Stations, A. C. True, Director, has issued Farmers' Bulletin No. 270, "Modern Conveniences for the Farm Home," by Elmina T. Wilson. 1916. 48 pp. Contains a treatise on the water-supply, all features of plumbing in the house, earth closets, disposal of wastewater and sewage, of ashes, garbage and miscellaneous refuse.
38. The Specifications for Construction of a Standard Building of the N.F.P.A. (3A3d31) state, "The lowest floor of the building shall be drained to a sump chamber, which is provided with adequate facilities for removing surplus water therefrom."
39. "The Prevention of Corrosion in Pipe," paper by F. N. Speller. 15 pp. Contains illustrations, diagrams, and tables. Reprinted from the *Journal of the American Society of Heating and Ventilating Engineers*.
40. See publication of the N.F.P.A. entitled, "Frozen Water-Pipes: A Winter Hazard" (3A3c6).
41. N.F.P.A. "Index" (3A3d5) contains references to information on Pipe and Standardization of Pipe and Pipe Fittings.
42. See "Building Code" recommended by the N.B. of F.U., 1915, pp. 225-229. Contains sections on "Plumbing," "Drainage," and "Electrical Requirements."
43. "The Superintendence of Piping Installations in Buildings—Sanitary, Hydraulic and Gas." William Paul Gerhard, C. E. 85 pp. A manual intended for the use of practising architectural superintendents, plumbing and health inspectors and all interested in the installation of piping systems. Contents include: Sewer, Water, and Gas Connections; Rough Work; Soil, Waste, Vent and Leader Systems and Drains; Water Pipes, Tanks, Meters, Boilers, Hot-Water Tanks, Pumps, etc.; Roughing for Plumbing Fixtures; Setting the Plumbing Fixtures; Turning on the Water and Gas; Tests of the Work; Records and Plans.
44. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see the following pages in the Industrial Section:
 - (a) "An Investigation of Pipe Corrosion in 125 Apartment Buildings," A. M. Byers Co., p. 225.
 - (b) "Crane Drainage Fittings," Crane Co., p. 218.
 - (c) Cast Iron Soil Pipe Mfrg. Asso., pp. 222, 223.

9G_a Separate Letting of Contracts

A committee of the American Institute of Architects, known as the Committee on Conference with the National Association of Master Plumbers and the National Association of Master Steam and Hot Water Fitters, held meetings with the joint committee representing those two organizations in 1913. As a result of such conference the Committee recommended to the American Institute of Architects the adoption of the following Resolution, which was formally adopted by the Convention of 1913 at New Orleans:

"Resolved, That the American Institute of Architects, in convention assembled, recommends to the members of our profession the adoption of the practice of direct letting of contracts for mechanical equipment, such as heating apparatus, plumbing, and electrical equipment. This recommendation is based on the conviction that direct letting of contracts, as compared with subletting through general contractors, affords the architect more certain selection of competent contractors and more efficient control of execution of work, and thereby insures a higher standard of work, and, at the same time, serves more equitably the financial interests of both owner and contractor."

9G_b Notes on Standardization of Cast-Iron Soil Pipe and Fittings

From a paper by Harry Y. Carson

For years, in fact since the New York City Plumbing Code of 1881, there have been specifications and requirements in all plumbing regulations governing the weight

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and wall thickness of soil pipe; but there have been no such specifications, until recently, which regulate soil-pipe fittings.

It is almost impossible in foundry practice to prevent a variation in individual pieces of as much as $\frac{1}{8}$ inch, and with the class of pipe known as "standard" calling for a wall thickness of but $\frac{1}{8}$ inch, when we consider this possible variation, we are confronted with the very real danger which must exist in pipe having a wall thickness at any point of $\frac{1}{8}$ inch.

In the casting of extra-heavy pipe with a wall thickness of $\frac{1}{4}$ inch, while the same variation is both possible and permissible, the factor of safety is far greater, for the wall of the pipe should not, with the observance of high standards in foundry practice, be less than $\frac{3}{8}$ inch—ample protection against leakage in the finished stack. That the leakage of gases of every nature is considered harmful is evidenced by the regulations adopted by all cities with respect to the test which must be applied to all plumbing prior to its approval by the plumbing inspectors, and it is not only sewer gas which may escape through the use of light wall pipe, but illuminating gas which enters the sewers through leaks in the gas mains.

That a specification for soil-pipe fittings, regulating not alone the weight of each fitting but its wall thickness, radii of bends, calking room, depth and thickness of hubs, and other essential dimensions, has long been needed is manifest by the efforts that have been made and the able work that has been accomplished in this direction during the past six years. A very desirable standard for soil pipe and fittings is now in existence, and it is being adopted in the larger cities of the United States. This standard is known as the "Naco" specification for soil pipe and fittings.

In 1911 a committee made up of sanitary engineers, jobbers of plumbing supplies, plumbing inspectors, and others familiar with trade conditions was delegated to report on this subject to the American Society of Sanitary Engineering.

A report of the Committee on Organization and Functions of Municipal Health Departments given in the Public Health Officials' Section of the American Public Association, Jacksonville, Fla., December 2, 1914, as reported on page 1258 of Vol. V (December, 1915) *American Journal of Public Health*, states:

"The lack of standardization appears in the requirements for some of the commonest fittings. We have noted variations in the weights required for soil pipe when called for under specific names, such as standard, medium, and extra heavy. While in soil pipe itself the variations noted were not great, yet in the fittings which go with the pipe and form an essential part of the drainage lines we find a complete absence of control except in a few of the codes of very recent date where notice has been taken of this omission from previous codes and the defect corrected. To illustrate, we have computed the per cent. variations of the weights given for some of the quite common fittings which were purchased on the open market and weighed by investigators of this form of plumbing supplies." (See Table on page 1259, *American Journal of Public Health*, December, 1915.)

The Committee of Health Officials further reported:

"This variation may have been due to variation in length of fittings as well as to variation in thickness of shell, but members of your Committee have personally examined some such fittings which had a thickness of shell of less than $\frac{1}{8}$ inch on one side and a scant $\frac{1}{8}$ inch on the other."

That no manufacturer had, prior to 1911, adopted any fixed standard for making up soil-pipe fittings is apparent from the table shown in the report. In fact, there are many instances where patterns become so confused that fittings marked "extra heavy" are actually of lighter weight than those marked "standard."

A study made of plumbing codes from some 200 of the leading cities in the United States revealed the fact that no attempt had as yet been made by boards of health or other proper authorities to regulate the dimensions and weights of soil-pipe fittings. It was therefore only natural that the chaotic condition shown by the above table should exist. A chief reason for the lack of standardization has been that under the highly competitive conditions in the soil-pipe business this situation has resulted in the marketing of fittings of the *lightest possible weight*. Such fittings are necessarily fundamentally weak, of bad design, and a practice permitting this, while it demands pipe of $\frac{1}{4}$ inch wall thickness, is ridiculously inconsistent. The stack is no safer and no more sanitary than the lightest and weakest fitting.

At the present writing it can be stated that all necessary progress has been made in creating the standard of weights and dimensions for extra-heavy soil-pipe fittings, so that now fittings can be furnished of such proportions as to correspond to the wall thickness and strength of extra-heavy pipe; yet, there persists today a lax attitude in many of our cities with regard to the advantages to sanitation and economy that follow the adoption of this standard. On the other hand, some of the larger and more progressive communities, such as Cleveland, Ohio, Portland, Ore., and the state of Wisconsin have not been slow to see those very real advantages which do come. Consequently these localities have passed laws that are now in effect and require that the extra-heavy fittings shall conform to the Naco specifications.

Recognizing that such inertia persists in many of our municipal governments, the American Society of Sanitary Engineering prepared and adopted, at its 1914 convention in Minneapolis, Minn., a resolution for the attention of those who influence plumbing and sanitary legislation. This resolution, as it appears in the Annual Proceedings of the Society, reads as follows:

WHEREAS, The National Committee of Confederated Supply Associations, representing the various associations of plumbing supply dealers, adopted, July 11, 1912, specifications called Naco specifications for the standardization of extra-heavy soil pipe and fittings, and

WHEREAS, Since these specifications do not conflict with the specifications and drawings already recommended by this Society, and represent a simple working basis for the establishment of a standard for extra-heavy pipe and fittings, therefore be it

Resolved, That Naco specifications be adopted by this Society as its standard for extra-heavy pipe, and that it be further

Resolved, That the Society, through its members, use their best efforts toward the adoption of this standard in the plumbing regulations of municipalities where they have influence, and also assist in the extension of the use of such pipe and fittings which comply with the standard hereby adopted.

The term Naco has been given to the specification as an identification motto, and this motto in reality accredits and honors the name of the National Committee of Confederated Supply Associations, they having been the prime movers in securing data for the ultimate specification adopted.

Committee A-3 of the American Society for Testing Materials, a Society which is working for the standardizing of all engineering materials, is giving the Naco specification equal prominence with the well-known standard specification of cast-iron water and gas pipe which came originally from the American and New England Water Works Association.

9H Fixtures and Fittings (See also 12H)

1. In its work on the technology of clays, the U. S. Bureau of Mines has issued:
 - (a) Bulletin No. 53, "Mining and Treatment of Feldspar and Kaolin in the Southern Appalachian Region."
 - (b) Bulletin No. 92, "Feldspars of the New England and Northern Appalachian States."
 - (c) Technical Paper No. 99, "Probable Effect of the War in Europe on the Ceramic Industries of the United States."
 - (d) A report on the purification of the Georgia kaolins, setting forth how this American product may be substituted for imported clays in the making of porcelain, etc., will be issued shortly.
2. Among the numerous publications of the U. S. Bureau of Standards, the following are of interest concerning fixtures and fittings:
 - (a) "Annual Report of the Director," 1916 (1A2a), contains the following regarding enameled iron: "Work has been undertaken upon the study of enamels for cast iron and steel. It was first necessary to secure proficiency in the proper treatment of metal and the application and fusion of the ground coats and enamel. A number of excellent undercoatings and enamels have been developed, both for cast iron and steel. A study of enamels possessing maximum resistance to solution is under way."
 - (b) Circular No. 45, "The Testing of Materials," gives requisite information (pp. 40, 41) on sewer pipes and drain tiles made of hard burnt clay; also, porcelain and white ware manufactured from white burning mixtures of kaolin, ball clay, feldspar, and flint.
 - (c) Other circulars and technologic papers, specific information about which will be furnished through the Journal, or copies of which may be had upon application to the Director, as noted under 1A2b.
3. The U. S. Geological Survey has issued:
 - (a) A chapter on "Mineral Resources of the U. S." (2A1d), entitled "Clay Working Industries and Building Operations in the Larger Cities," a section of which is devoted to "Pottery."
 - (b) A large number of bulletins and separate chapters (2A1d and g) dealing with clays, iron, and other materials entering into the manufacture of plumbing fixtures and of other plumbing materials. Specific information will be furnished through the Journal, or the publications may be had upon application to the Director, as noted under 2A1.
4. For detailed drawings and descriptions of all kinds of plumbing fixtures used as "standard" in Government installations, see "Specifications for Plumbing Fixtures, etc., for the Treasury, War and Navy Departments," mentioned under 9A1 and described on p. 146 of "Mechanical Equipment of Federal Buildings under Control of the Treasury Department" (9G1), in which it is said: "The board which prepared this specification has produced a document remarkable for both scope and accuracy, and has rendered a substantial service to sanitary engineers and to the manufacturers in this line of business. Engineers and architects who have had to hear and weigh the claims and counter claims of representatives of various plumbing-material houses will undoubtedly appreciate the relief which the standardization brings."
5. "Mechanical Equipment of Federal Buildings," Chapter IV (9G1), contains "Report of Committee on Toilet Regulations for Industrial Plants." This Committee was appointed by the Chairman of the Sanitary Section of the Boston Society of Civil Engineers to consider the regulations for toilet facilities in industrial establishments, and its report contains valuable basic data upon the subject of proportioning plumbing fixtures to occupants of buildings.
6. "The Development of the Ceramic Industries in the United States," A. V. Bleining, Ceramic Chemist, Bureau of Standards, Pittsburgh, Pa. An address delivered before the Franklin Institute, November 2, 1916.
7. See *Journal of the Society of Constructors of Federal Buildings*, March, 1915, pp. 160-164, for address by Mr. T. Nelson Kise on "Vitreous China Plumbing Fixtures" and discussion which followed.
8. For developments in the art of ceramics, which include the manufacture of porcelain and vitreous ware plumbing fixtures, see the publications of the American Ceramic Society, listed under 3C1, including "A Bibliography of Clays and the Ceramic Arts" (3C1b).
9. "Water-Closets," Glenn Brown, Architect. A Historical, Mechanical, and Sanitary Treatise. Contains over 250 engravings, drawn expressly for the work by the author. The descriptions are particularly full and thorough.
10. See "Sanitary Engineering of Buildings" (9L24), W. P. Gerhard, for information on Plumbing Fixtures, and The Proper Arrangement of Water-Closet and Bath Apartments.
11. In "Mechanical Equipment of School Buildings" (9G8), by H. L. Alt, note Chapters V, VI, VII, and VIII, as of interest in connection with fixtures and fittings.
12. "Modern Sanitary Engineering" (9L29), Thomson Gilbert, contains information regarding Water-Closets, Flushing Cisterns and Pipes, Urinals, Baths, Lavatory Basins, Sinks, Tubs, and other fixtures.
13. "Sanitary Plumbing and Drainage" (9G12), J. W. Hart, contains data on Baths and Fittings, Lavatories, Sinks, and other fixtures.
14. "How to Drain a House" (9G10), G. E. Waring, treats of Plumbing Appliances, Wash-Stands, Water-Closets, Sinks, and other fixtures.
15. "The Building Estimator's Reference Book," 1917, Frank R. Walker: Section on "Plumbing, Sewerage and Gas Fitting," pp. 3100-3115, gives information regarding the size and cost of all plumbing fixtures.
16. "I.C.S. Plumbers' and Fitters' Handbook" (9G23): Section on "Plumbing Fixtures" gives information on Baths, Dimensions of Baths and Foot-Baths, Wash-Basins, Water-Closets, Urinals, Sinks, Laundry Tubs, and Swimming-Pools.
17. "I.C.S. Building Trades' Handbook" (9G24) gives information and tables on the sizes of fixtures.
18. See reports of committees of the American Institute of Metals and of the National Association of Brass Manufacturers on standardization of metal plumbing accessories.
19. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see the following pages in the Industrial Section:
 - (a) Kohler Enameled Ware Tubs, Lavatories and Sinks, Kohler Co., pp. 214, 215.
 - (b) "Impervio" Vitreous China and "Ideal" Solid Porcelain Tubs, Lavatories and Water-closets, The Trenton Potteries Co., p. 217.

9H1 Bathroom and Laundry Finishes and Accessories

Of much interest in connection with plumbing installations is the finish of the walls and floors in any bathroom, toilet, and other place given over to similar use.

The extensive use of tile for this purpose makes it desirable to call attention to the information pertaining to the service and products of the Associated Tile Manufacturers contained on page 211 of the Industrial Section.

Information concerning marble and slate will be found in the February issue under 2F and 2K.

Illustrations and descriptions of various china bathroom accessories, such as towel-bars, soap-holders, and many others, will be found in the catalogues of the manufacturers.

As of interest in connection with laundry installations, see information pertaining to Glass Enameled Steel Laundry Chute, on page 213, in the Industrial Section by The Pfaunder Co.

9J Swimming-Pools, Baths, Bath- and Change-Houses (See also 9M)

1. The Bureau of Mines has issued:
 - (a) Technical Paper No. 33, "Sanitation at Mining Villages in the Birmingham District, Ala." (9L1a), which contains a brief section on "Bath and Change House."
 - (b) Technical Paper No. 116, "Miners' Wash and Change Houses," J. H. White, 1915, 23 pp. Contains information on the advantages of wash and change house; extent of installations; comparative inexpensiveness; location of building; artificial lighting and heating; drying arrangements; lockers; shower baths preferable to bathtubs; water-mixers and -heaters; number and construction of shower-booths; swimming-pools; quality and quantity of water required; public laundries; plumbing. Contains illustrations, plans, sections and details of wash and change houses. Price, 10 cents.
 - (c) Bulletin No. 87, "Houses for Mining Towns" (8L1e), contains information and one illustration regarding the "Wash and Change House."
- A number of wash and change houses have been described in various mining magazines and other publications, and some of the recommendations contained in the publication described under 8J1b are based on information derived from these descriptions. Some of these references are given in the list following:
 2. "Miners' Change and Bath House," A. F. Allard, *Coal Age*, Vol. 3, January, 1913, pp. 115-116, describes bath house at coal-mine near Clinton, Ind.

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3. Bulletin No. 7 of the American Iron and Steel Institute, Vol. 1, July, 1913.
4. "Report of Committee Appointed by Illinois Coal Operators' Association to Draw up Standards for Wash and Change Houses," *Black Diamond*, Vol. 52, November, 1914, 363 pp.
5. "Miners' Baths," H. F. Bulman and W. B. Wilson, *Coal Age*, Vol. 2, November, 1912, pp. 619-620. Discusses bath houses in Europe; also in Coll. Eng., Vol. 35, October, 1914, pp. 140-143. Describes construction and use of bath-houses in England and on the Continent.
6. "European Wash House Practice," *Coal Age*, Vol. 11, January, 1912, pp. 502-505; February, pp. 538-540, 573, 574. Discusses in detail wash houses at European mines.
7. "Suggestions for New Zealand Mines," *Coal Age*, Vol. 2, September, 1912, pp. 397, 398. Describes bath house recommended by New Zealand Royal Commission on Mines.
8. "Bath House at Shamokin, Pa," *Colliery Engineer*, Vol. 33, July, 1913, pp. 679, 680.
9. "Welfare Work of a Coal Company," *Colliery Engineer*, Vol. 34, March, 1914, pp. 497, 498. Describes bath house at anthracite mine in Pennsylvania.
10. Report of the Departmental Committee of the Committee on Provisions for Washing and Drying at Mines, appointed by the Secretary of State for the Home Department of Great Britain to consider the provision of washing and drying accommodations at mines under Section 77 of the Coal Mines Act of 1911.
11. "Wash Houses at Coal-Mines," *Engineering and Mining Journal*, Vol. 83, April, May, 1907, pp. 675, 1012. Short editorials on the advantages of wash and change houses at mines.
12. "Change House at Franklin Furnace, N. J.," *Engineering and Mining Journal*, Vol. 94, August, 1913, pp. 358, 359.
13. "Change House with Novel Features," *Engineering and Mining Journal*, Vol. 97, March, 1914, pp. 521-523. Describes wash and change house at mine in the Menominee Range.
14. "Examples of Modern Sanitary Dry Houses," A. H. Fay, *Engineering and Mining Journal*, Vol. 88, October, 1909, pp. 822-824. Describes bath houses at three Minnesota and Michigan iron properties.
15. "Observation in Coal Mines of Europe," Frank Haas, *Engineering and Mining Journal*, Vol. 89, April, 1910, p. 730. Describes bath house at a German coal-mine.
16. "Wash and Change Houses Abroad," *Iron and Coal Trades Review*, Vol. 83, 1911, pp. 848-850, 866, 887.
17. "Description of Several Wash Houses in England," *Iron and Coal Trades Review*, September, 1914.
18. "A Wash House for Coal Miners," L. Peyton, *Engineering and Mining Journal*, Vol. 91, March, 1911, p. 604. Describes wash house at Benton, Ind.
19. "A Modern Twin Coal-mining Plant," W. R. Roberts, *Coal Age*, Vol. 1, December, 1914, p. 236. Describes bath-house at coal-mine near Danville, Ill.
20. "Change House with Swimming-Pools," A. H. Sawyer, *Engineering and Mining Journal*, Vol. 98, 1914, pp. 483, 484. Describes change house with two pools, one for white and one for colored miners, at Raimund mines, near Bessemer, Ala.
21. "A Change House for Coal Miners," A. A. Steel, *Mines and Minerals*, Vol. 32, June, 1912, pp. 647, 648. Suggests plans for construction and methods of keeping building in order.
22. For "School Baths" see "Sanitation of Public Buildings," W. P. Gerhard (9G4), Part IV.
23. For "Toilet Partitions and Shower Baths in Schools" see "Mechanical Equipment of School Buildings." (9G8.)
24. See reference to Baths and Swimming-Pools in "Plumbers' and Fitters' Handbook." (9H61.)
25. "Modern Baths and Bath Houses," Wm. Paul Gerhard. 311 pp., illus. Contents include: Historical Notes on Bathing; The Different Forms of Baths; The Modern Rain Bath; House and Tenement Baths; Public Bath-Houses; People's Baths; Factory Baths, School Baths; Baths for Military Barracks, Prisons, and Jails; Hospital Baths; Baths for Club Houses, Gymnasias, Hotels and Barber Shops; River and Sea Baths; Air and Sun Baths; Medical and Electric-Light Baths; The Water Supply and Plumbing of Bath-Houses; Bibliography on Baths and Bathing; Appendix—Bathing in Various Countries; The Dog Bath.
26. "Turkish Baths," R. O. Allsop, Architect. Illustrated with plans and sections from scale drawings by the author. Describes the Turkish bath, its design and construction for public and commercial purposes, with chapters on the adaptation of the bath to the private house and institutions.
27. "Baths," R. O. Allsop. 98 pp., illus. Describes public baths and wash houses.
28. "Architects' and Builders' Pocket Book" (9G9), F. E. Kidder, gives information on Plunge Baths and Symbols for Plumbing.
29. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see "Swimming-Pools," a 32-page book, 8½ x 11, with plans, sections, details and photographic illustrations of tiled pools and accessories, copyrighted 1917 by the Associated Tile Manufacturers. (See p. 211 in Industrial Section.)

9K Sprinklers and Fire-Protection

References were given in the April Journal, Serial No. 4, under 4F "Fittings, Contents and Protection Equipment" to the publications of the various fire prevention authorities. In addition to those and to the papers, articles, and discussions listed in the N.F.A. Index therein referred to, others on various phases of the subject will be found listed in the indexes of the water works associations and the engineering societies referred to in this issue, and the use of water in connection with fire extinguishment is of course treated in many of the publications listed in this issue under the 8D Division.

The following letter from the Chairman of the Institute Committee on Materials and Methods is printed as of interest in connection with this subject.

9K1 Concerning Underground Piping for Sprinkler Installations

July 19, 1917.

To the Structural Service Department
of the Journal of the A.I.A.:

I have received from the United Association of Plumbers and Steam Fitters of the United States and Canada a communication addressed to the members of the American Institute of Architects and signed by Mr. John R. Alpine, the General President of this Association. The letter states, among other things, that:

"For many years you have been disturbed because of industrial conflict arising in connection with your building operations, and with which you as architects were not concerned, but which caused you builders, owners, and the public generally much discomfiture and great loss of

money because of stoppage of work. The industrial disturbances referred to are commonly known as jurisdictional disputes between trades engaged in the building industry, or, in other words, internecine disputes between building trades, each laying claim to a certain form of work, and one striking against the other in order that control over the work in dispute might be secured.

"For some time past we have been troubled with the question of jurisdiction as concerns the installation of what is known as underground piping, when such underground piping comes in connection with the installation of sprinkler equipments. The United Association of Plumbers, Steam Fitters, Sprinkler Fitters, etc., is granted by the American Federation of Labor trade jurisdiction over all forms of pipe fitting, except conduit piping for electrical purposes, and underground piping of all descriptions comes within the jurisdictional scope of the United Association. We frequently have internal disputes because of the fact that when sprinkler contracts are awarded, underground pipe work, in connection with sprinkler equipments, is frequently awarded separately from the sprinkler contract, and awarded to plumbing and steam-fitting concerns. When it comes time to install this underground work the sprinkler fitter contests the right of the plumber or steam fitter to make the installation, and the plumber or steam fitter maintains his right to do this work because it comes within the contract of his employer.

"Since this is the case, we maintain that neither one has the right to encroach upon the work of the other; yet when a contract embracing work that clearly belongs to one class of men is subdivided, and portions of such contract awarded to another class of men, our task is made exceedingly difficult. Trouble ensues and architects, owners, builders, and the public generally are involved as well as the men who are participating in the contest. Of course, ultimately, we dispose of these disputes, but not until much discomfiture and loss has been experienced by all concerned.

"Underground piping herein referred to means cast-iron or wrought iron piping, representing underground mains, branches, etc., from city mains, pumps, reservoirs, tanks, hydrants when in connection with sprinkler equipments, etc., and I am sending this letter to the members of your Association with the hope that you may be helpful in the future in having this class of work included in the general sprinkler equipment contract, thereby obviating the chance of jurisdictional differences arising on buildings, since these jurisdictional differences, as applying to this class of work, are created because of the subdivisions of the contract

awarded in such work to plumbing and steam-fitting contractors, when in reality the work should be included in the general sprinkler contract, which belongs to the sprinkler fitter. Coöperation on your part in regard to retaining this underground work, or other work in connection with sprinkler contracts within the contract covering sprinkler installation, will aid us materially, and tend toward the successful and speedy completion of building operations and better and more satisfactory installations of fire-preventive devices."

The Chairman of the Institute Committee on Materials and Methods feels that this is a matter which might at least be called to the attention of the profession and given careful consideration by its members. If further detailed information is desired, and if the full discussion of the subject, as embodied in the complete circular letter sent out by the Association, is wanted, all can be obtained by writing to the office of the General President, 401 Bush Temple, Chicago, Ill.

THOMAS NOLAN,

Chairman of Committee on Materials and Methods.

[EDITOR'S NOTE.—Without wishing to enter into any phase of a controversy between organizations of any kind,

it would nevertheless appear to be advantageous to keep as much work as possible concerning any one installation under the control of any one contractor making that installation, thereby unifying instead of dividing the responsibility for the equipment and its successful operation.]

9K2 Safeguarding Industry—A Wartime Necessity

This is the title of a 24-page book prepared by the National Board of Fire Underwriters for the Council of National Defense, which is replete with practical suggestions for reducing fire-loss.

This book is described and quoted from with particular reference to conservation through the use of sprinklers by the Information Service Department of the National Automatic Sprinkler Association on pages 180–183 of the Industrial Section.

9L Outgoing Pipes, Sewage Disposal and Public Health

As stated in the introductory paragraph to the Division 9D, the question of water-supply and distribution is similar in importance with the question of sewage disposal as concerns the public health.

No better introduction to this Division could be given than Mr. Ihlder's article printed under 9C1, to which the attention of the reader is directed.

Both of these subjects are covered by activities and publications of the Bureau of the Public Health Service mentioned under 9M. See, also, various publications of the U. S. Department of Agriculture, some of which follow, but a fuller list of which will be found under 12H.

1. The U. S. Bureau of Mines has issued:
 - (a) Technical Paper No. 33, "Sanitation at Mining Villages in the Birmingham District, Ala.," Dwight E. Woodbridge. 1913. 26 pp. Contains illustrations and map.
 - (b) Technical Paper No. 117, "Quantity of Gasoline Necessary to Produce Explosive Conditions in Sewers," G. A. Burrell and H. T. Boyd. 1916. 17 pp., diagrammatically illustrated. Price, 5 cents.
 - (c) Miners' Circular No. 20, "How a Miner Can Avoid Some Dangerous Diseases," A. J. Lanza and J. H. White. 1916. 26 pp. Contains, among others, two illustrations, being front and rear drawings of a sanitary privy. Price, 5 cents.
 - (e) Bulletin No. 87, "Houses for Mining Towns," J. H. White. 1914. 64 pp. Contains a treatise on the subject of the small house in groups and as small towns. Includes a discussion of the town-site and enlargement of town with streets and alleys, types of houses, windows, doors, lighting, ventilation, screening, heating, interior and exterior finish, construction, the yard and its appurtenances, sources of water supply, disposal of wastes, sewer systems, substitutes for sewers, and other subjects of vital interest as affecting the public health. Illustrated with map of model mining town, plans, elevations and perspectives of houses, details of construction, and other data. Price, 15 cents.
2. See "Proceedings" of the American Society of Civil Engineers for lists of "Current Engineering Literature" on sanitation and other subjects covered by this issue.
3. See "Review of Current Technical Literature" and *Journal of the American Society of Mechanical Engineers* for information on these subjects. Also reports of committees in that Society on Flanges and on Standardization.
4. "Modern Methods of Sewage Disposal for Towns, Public Institutions, and Isolated Houses," G. E. Waring. 247 pp., illus. Contents include: Selection of Method of Disposal; Sewage Irrigation, Farming and Filtration; Chemical Treatment; Rights and Obligations of Riparian Owners; Disposal for Large Institutions, and Hotels; Disposal for Village and Country Houses.
5. "Sewerage and Land Drainage," G. E. Waring. Illus.
6. "How to Drain a House" (9G10), G. E. Waring.
7. "Guide to Sanitary Inspections," Wm. Paul Gerhard. 229 pp. Contents include: Essentials of a Healthful Home; Schedule for Sanitary Inspection of Tenement Houses; Inspection of Country Houses; Summer Boarding-Houses and Summer Resorts; Schedule for Sanitary Inspection of Schools, Hospitals, and Institutions;

- Sanitary Inspection of Dairies; Sanitary Surveys of Cities and Towns; Bibliography on Sanitary Surveys and Inspection.
8. See "Sanitation of Public Buildings" (9G4), Wm. Paul Gerhard, for sections relating to drainage systems and sewage disposal.
9. "Water Supply, Sewerage, and Plumbing of Modern City Buildings" (9G5), Wm. Paul Gerhard.
10. "The Sanitation, Water Supply and Sewage Disposal of Country Houses" (9G7), Wm. Paul Gerhard. Treats of the general sanitation of country houses and shows relation of the soil, the sub-soil, surface drainage, sewage, etc., to a healthful home. The question of sewage disposal for houses not in reach of sewers is taken up, and latest developments in methods of disposal are given particular attention.
11. See "American Civil Engineers' Pocket Book" (9G22), M. Merriman, pp. 967–980: Section on "Sewerage Systems." See, also, section on "Sewage Disposal," pp. 980–997.
12. "The Separate System of Sewerage: Its Theory and Construction," C. Staley and G. S. Pierson. 324 pp., illus. Contents include: Plans, Specifications and Contract, Construction, House Drainage and Plumbing, Purification of Sewage by Application to the Soil.
13. "The Design, Construction and Maintenance of Sewage Disposal Works," Hugh P. Raikes. 429 pp., illus. A practical guide to modern methods of sewage purification.
14. "The Purification of Sewage," S. Barwise. 234 pp., illus. A brief account of the scientific principles of sewage purification and their practical application.
15. "Elements of Sanitary Engineering," M. Merriman. 250 pp., illus. Contents include: Sewage Systems; Disposal of Sewage, Refuse and Garbage; The Chicago Drainage Canal; British Commissions on Sewage Disposal.
16. "Practical Methods of Sewage Disposal," Henry N. Ogden and H. Burdett Cleveland. 132 pp., illus. Contents include: The Settling Tank; Valves, Siphons, and Siphon Chambers; Subsurface Irrigation; Sewage Filters; Broad Irrigation; Estimates of Cost.
17. "Sewer Design," H. N. Ogden. 248 pp., illus. Contents include: Preparatory Maps and Data; Estimating Future Population; Amount of Sewage per Capita; Ground-water Reaching Sewers; Sewer Diagrams; Plans and Cross-section.
18. "Sewer Construction," Henry N. Ogden. 335 pp., illus.
19. "Sewage Disposal," Leonard P. Kinnicutt, C. E. A. Winslow, and R. Winthrop Pratt. 435 pp., illus.
20. "Sewerage," A. Prescott Folwell. 506 pp., illus. The Designing, Construction, and Maintenance of Sewerage Systems, in three parts.
21. "Sewage Disposal," G. W. Fuller. 767 pp., illus. A comprehensive work with a comparison of values and data on methods, which includes a chapter on Institutional and Residential Plants.
22. For "Sewage Purification Plants for Small Country Residences and Isolated Buildings," see paper with this title by A. P. I. Cotterell, in the *Journal of the Royal Sanitary Institute*, June, 1916.
23. For recommendations as to "Sanitary Provisions for Medium-Sized Stations," see adopted Report of Committee on Buildings, Manual of the American Railway Engineering Association (1A9c), p. 218.
24. See "Sanitary Engineering of Buildings," Wm. Paul Gerhard, which contains Chapters on Sewerage of Buildings; Sewage Removal and Sewage Disposal; A Plea for Sanitation in Factories and Workshops; The Sanitary Drainage of Tenement Houses, and others as listed under 9G6.
25. "Mechanical Equipment of School Buildings" (9G8), H. L. Alt. Chapter XIII contains information on Sewage Disposal.

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26. See "Architects' and Builders' Pocket Book" (9G9), F. E. Kidder, for information on Plumbing and Drainage, including reliable rules for same, and data regarding drains, sewers, etc.
27. "Architectural Hygiene and Sanitary Science as Applied to Buildings," R. F. and M. T. Fletcher. Illus. A textbook for architects, surveyors, engineers, and others, with many diagrams and figures.
28. See "A Guide to Sanitary House Inspection" or, "Hints and Helps Regarding the Choice of a Healthful House in City or Country," by Wm. Paul Gerhard.
29. See "Modern Sanitary Engineering;" Part 1, "House Drainage," Thomson Gilbert, for principles of drainage design, materials, gradients and other data as listed under 9G.
30. "Domestic Sanitation and Plumbing" (9G13), A. Herring-Shaw, contains sections on Soil, Waste and Vent Pipes; Sanitary Fittings; House Drainage; Cesspools; Disposal of House Sewage.
31. "I.C.S. Plumbers' and Fitters' Handbook" (9G23) contains a section on Drainage and Sewerage, which treats of Capacity of Circular Sewers; Sewer Pipe; Double Strength Sewer Pipe; Roof Leaders; Sewage Ejection; and Disposal of Sewage.
32. See Starbuck's "Drainage and Venting," Vol. I, 160 pp., illus.
33. Gillette's "Handbook of Cost Data," 1850 pp., contains information on the cost of Sewers.
34. "American Sewerage Practice," Leonard Metcalf and H. P. Eddy: Vol. I, "Design of Sewers," 747 pp., illus. Vol. II, "Construction of Sewers," 564 pp., illus., gives detailed descriptions of every step of trenching and the construction of pipe, masonry, and concrete sewers. Vol. III, "Disposal of Sewage," 878 pp., illus., explains in simple language the nature of sewage and the changes that take place in it when it is subject to different conditions and describes the structures designed to produce these various conditions.
35. For descriptions and illustrations of reinforced concrete sewers installed by the city of Hartford, see Eighth Annual Report of the Department of Engineering, City of Hartford, Conn. See Ninth Annual Report of same Department, concerning tile block sewers.
36. See "Water Pipe and Sewer Discharge Diagrams," T. C. Ekin, listed under 9D34.
37. The "Building Code" recommended by the N.B.F.U. (9G42) contains Section 257 on Plumbing and Drainage, which gives requirements to be followed in connection with the alteration or change of plumbing and drainage systems.
38. "Water Purification and Sewage Disposal," J. Tillmans. Translated by Hugh S. Taylor. 169 pp., illus. Embodies a critical survey of the work of the German authorities during the past few years in developing modern methods for the provision of suitable water-supplies and the adequate disposal of sewage, with a chapter on the disposal of industrial sewage.
39. See "What Our Cities Do Not Know," published 1915 by National Housing Association. Describes existing conditions in cities throughout the country as to vaults, privies, sewers, and general sanitation, with progress in legislation, law enforcement and improved dwellings, with a list of limited dividend companies in the United States and Canada which are seeking to improve wage-earners' dwellings in villages, together with a list of official commissions or departments and of volunteer housing associations or committees.
40. The National Housing Association issues many pamphlets, booklets, and other publications pertaining to all phases of housing, in many of which the subject of sanitary conditions is fully gone into. These are to be had at very nominal prices, and their study and distribution is to be encouraged.
41. For description of existing sanitary conditions, with summary and recommendations as to improving conditions in the city of Providence, R. I., and surrounding communities and some mill villages, and as applicable to many others, see "The Houses of Providence," John Ihlder and others, 1916.
42. See the "Annual Report of the Rockefeller Foundation," 1915, for information on "The Latrine Problem," pp. 60-65, as submitted in the Report of the Director General of the International Health Commission to the President of the Rockefeller Foundation from which the following is quoted.
 - (a) "In what has already been done there is sufficient volume and variety of experience to afford a satisfactory basis for a critical study of the advantages and disadvantages or relative efficiency of the various methods employed for the disposal of sewage at the rural home. The state departments of health are eager to have this study made and offer coöperation in carrying it out; the Commission is prepared to coöperate by supplying the necessary funds for the work; working plans are being matured; the results of the many scientific studies that have been made of different phases of the problem are being summarized; and it is hoped that the investigation may be under way within the coming year. The work, if undertaken, will need to extend over a long period of time and to cover a considerable area of field work in order to test experience under all seasons and under a sufficient variety of conditions. The aim will be to subject present procedures to scientific examination with a view to pointing the way, if possible, to a method for the disposal of sewage at the country home that will be safe and that will be workable under prevailing conditions."
 43. The U. S. Bureau of Standards has issued Technologic Paper No. 44, "Investigation of the Durability of Cement Drain Tile in Alkali Soils," 1915. 56 pp. Contains illustrations, tables and diagrams. Price 35 cents.
 44. For information on "Vitrified Salt-Glazed Sewer Pipe," with dimensions, weight and cost, see "Lefax" Data Sheet 6-94.
 45. For publications dealing with the make and use of especial kinds of pipes and sewers, see those referred to elsewhere as follows:
 - (a) Cast Iron Soil Pipe Makers Association (9B5).
 - (b) American Concrete Pipe Association (9B6).
 - (c) The Sewer Pipe Manufacturers' Association (9B7).
 46. See Paper read at the 1917 Convention of the A.S.T.M., entitled "Distribution of Pressure through Earth Fills," A. T. Goldbeck.
 47. Besides the Standard Specifications for Cast-Iron Pipe and Special Castings, mentioned under (9D41) the American Society for Testing Materials has issued:
 - (a) Standard Specifications for Drain Tile, Serial Designation C4-16, adopted 1914, revised 1916. These specifications cover three classes of drain tile, namely, Farm Drain Tile, Standard Drain Tile, and Extra-Quality Drain Tile, and apply to drain tile made of shale, fire-clays or surface clays, and to drain tile made of concrete. See reference to Report of Committee C-6 on Drain Tile.
 - (b) Standard Definitions of Terms Relating to Sewer Pipe, Serial Designation C8-15, adopted 1915.
 - (c) Report of Committee C-4 on Clay and Cement Sewer Pipe, 1916, presents, under the title Appendix 1, "Analytical Data for Sewer Pipe."
 - (d) In the report of the same committee, C-4, for 1917, the Committee presents the following, with a recommendation that these proposed standards be printed as tentative for one year before being presented to the Society for adoption: Proposed Tentative Specifications for Clay Sewer Pipe. Proposed Tentative Specifications for Cement-Concrete Sewer Pipe. Proposed Revised Tentative Recommended Practice for Laying Sewer Pipe. Proposed Tentative Specifications for Trench Pressures upon Sewer Pipe.
 48. The Public Comfort Station Bureau of The National Committee of the Confederated Supply Association (J. J. Cosgrove, Director, 261 Broadway, New York City) has published the following:
 - (a) A circular of "Suggestions for Organizing Locally in the National Campaign for Public Comfort Stations," 4 pp.
 - (b) "The American Plan for Public Comfort Stations," approved by the Bureau. 8 pp.
 - (c) Standards for Public Comfort Stations," approved by the Bureau. 8 pp.
 49. See "Public Comfort Stations," 8 pp., text and illustrations (foreign) in *Modern Sanitation*, August, 1913.
 50. For further descriptive matter and illustrations pertaining to subjects covered by this heading, see the following pages in the Industrial Section:
 - (a) Crane Drainage Fittings, Crane Co., p. 218.
 - (b) Cast Iron Soil Pipe Mfgs. Assn., pp. 222, 223.
 - (d) "Safe Disposal of Human Excreta at Unsewered Homes," Public Health Bulletin, No. 68. L. L. Lumsden, C. W. Stiles, and A. W. Freeman. 1915. 22 pp.
 - (e) "A Sanitary-Privy System for Unsewered Towns and villages, Public Health Bulletin No. 89, August, 1917, by L. L. Lumsden, Surgeon. 28 pp., illustrated and with list of Service Publications.

9M United States Public Health Service

1. There is in the Treasury Department a Bureau of the Public Health Service in charge of Surgeon-General, Rupert Blue, Surgeon-General's office, 3 B Street, S. E. This Service maintains a Hygienic Laboratory at 25th and E Streets and issues:
 - (a) Hygienic Laboratory Bulletins.
 - (b) Public Health Bulletins.
 - (c) Reprints from Public Health Reports.
 These relate, among other things, to Water Supplies, Rural Sanitation and Sewage Pollution. List of related publications will be found in back of Bulletin No. 89 below, and those not exhausted may be obtained without charge from the Service. Among these are:
 - (d) "Safe Disposal of Human Excreta at Unsewered Homes," Public Health Bulletin, No. 68. L. L. Lumsden, C. W. Stiles, and A. W. Freeman. 1915. 22 pp.
 - (e) "A Sanitary-Privy System for Unsewered Towns and villages, Public Health Bulletin No. 89, August, 1917, by L. L. Lumsden, Surgeon. 28 pp., illustrated and with list of Service Publications.
2. As of further interest, see "Report of the Surgeon-General, U. S. Army, to the Secretary of War," 1917. 474 pp., with diagrams and tables, descriptions of conditions affecting military Hospitals, Laboratories, Medical Schools, etc.

Serial No. 10

HEATING AND VENTILATING AND MECHANICAL EQUIPMENT IN GENERAL

OCTOBER, 1917

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10A Societies, Associations and Other Interests

The publications and activities of the following Societies in the development of mechanical equipment will be mentioned wherever possible in connection with the main heading or subdivision under which they would naturally fall.

1. AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Secretary: Calvin W. Rice, 29 W. 39th Street, New York City.
2. AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
Secretary: C. W. Obert, 29 W. 39th Street, New York City.
3. AMERICAN INSTITUTE OF CONSULTING ENGINEERS
Secretary: F. A. Molitor, 35 Nassau Street, New York City.
4. NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS
Secretary: Henry B. Gomers, 50 Union Square, New York City.
5. NATIONAL DISTRICT HEATING ASSOCIATION
Secretary: D. L. Gaskill, Electric Building, Greenville, Ohio.
6. NATIONAL WARM AIR HEATING AND VENTILATING ASSOCIATION
Secretary: A. W. Williams, Columbus, Ohio.
7. AMERICAN ASSOCIATION OF REFRIGERATION
Secretary: J. F. Nickerson, 431 S. Dearborn Street, Chicago, Ill.
8. AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
Secretary: W. H. Ross, 154 Nassau Street, New York City.
9. AMERICAN UNIFORM BOILER-LAW SOCIETY
Chairman Administrative Council: Thomas E. Durban, Erie, Pa.
10. AMERICAN BOILER MANUFACTURERS' ASSOCIATION
Secretary: H. N. Covell, 191 Dikeman Street, Brooklyn, N. Y.
11. NATIONAL BOILER AND RADIATOR MANUFACTURERS' ASSOCIATION
Secretary: F. W. Herendeen, Geneva, N. Y.
12. MAGNESIA ASSOCIATION OF AMERICA
Secretary: C. J. Stover, Bulletin Building, Philadelphia, Pa.
13. LOW PRESSURE COVERING MANUFACTURERS' ASSOCIATION
Secretary: C. J. Stover, Bulletin Building, Philadelphia, Pa.
There is also record of the
14. BOILER TUBE MANUFACTURERS OF AMERICA
15. NATIONAL TUBULAR BOILER MANUFACTURERS' ASSOCIATION
16. NATIONAL ASSOCIATION OF VALVE MANUFACTURERS

10B Educational and Research Work (See, also, 1B3g and 3C2a)

1. In the *Heating and Ventilating Magazine*, April, 1917, it is stated that President Lyle, of the A.S. of H. and V. Engineers has appointed a committee to investigate the matter of the establishment of a bureau of research to be conducted under the auspices of the Society. When John Bartlett Pierce, one of the founders of the American Radiator Company, and its Vice-President,

died at his home in Lynnfield, Mass., June 23, 1917, his will was found to create a substantial surplus fund to be used for the establishment of the John B. Pierce Foundation for technical research in heating, ventilating, and sanitation "to the end that the general hygiene and comforts of human beings and their habitations may be advanced."

10C Boilers and Heating in General

10C1 Departments of U. S. Government

Issue publications concerning heating, ventilation, and mechanical equipment, both as scientific, technical papers on the production, combustion, and utilization of fuel, and popular literature on home conveniences and economies.

- (a) Fuels. See 2A3, 2A1c and d.
- (b) Bureau of Mines: Technical Paper 97, "Saving Fuel in Heating a House," 1915. 35 pp., illus. Also, 10C4jj.
- (c) Bureau of Standards: "Investigation of Fusible Tin Boiler Plugs," 1915, and other Technologic Papers; also Bulletins and other publications (1A2b) for index to which see "Publications of the U. S. Bureau of Standards," May 8, 1917.
- (d) Navy Department issues specifications in large number for many kinds of materials, pipes, tubing, valves, and other apparatus and devices, and for mechanical systems and appurtenances. Read the "Index to Specifications" (3A1a1), for titles and Navy Department serial numbers.
- (e) War Department. (See Journal for September, pp. 423-424.)
- (f) Treasury Department, office of Supervising Architect (see 8B, p. 93). Specifications are issued, but not for general distribution, as mentioned under 5D2b.

- (g) Department of Agriculture: For one of the many interesting publications, see 10D1, and for list of others see 12H.
- (h) U. S. Weather Bureau compiles for the *Heating and Ventilating Magazine* complete records of the weather in five different localities, which are published, with charts and complete data.
- (j) Department of Commerce: "Abstract of the Census of Manufacturers, 1914," but actually taken in 1915. Contains data on hot-air furnaces, radiators, cast-iron boilers, stoves and ranges, steam and fittings. Price 65 cents, from Superintendent of Documents, Government Printing Office, Washington, D. C.

10C2 Boiler Standards

- (a) While the Constitution of the A.S.M.E. states that "the Society shall not approve or adopt any standard or formula," the Report of the Boiler Code Committee, commonly known as the "Boiler Code," was accepted by the Council of the Society on Feb. 13, 1915, and ordered printed. It is now recognized as a Standard and has been printed by some states, either *in toto* or with modifications, as the law of the commonwealth. It has also official recognition by the important insurance companies featuring this class of protection.

The official title is "Report of the Committee to Formulate

STRUCTURAL SERVICE BOOK

Standard Specifications for the Construction of Steam Boilers and other Pressure Vessels and for Their Care in Service, Known as the Boiler Code Committee." These "Rules for the Construction of Stationary Boilers and for Allowable Working Pressures" are divided into Section I, Power Boilers; Section II, Heating Boilers.

The A.S.M.E. Boiler Code was issued over the signatures of twenty-four experts, representing every phase of steam-boiler practice, and this body has been continued as a committee to interpret the Code when occasion requires. Thus far 172 rulings and interpretations of importance to engineers have been published. (See *Journal* of the A.S.M.E. for the monthly reports of "The work of the Boiler Code Committee.") The Boiler Code is now undergoing its first revision.

- (b) Many of the specifications for materials comprised within the Code are identical with or modifications of separate standards of the A.S.T.M., which see.
- (c) The A.S.M.E. also issues reports containing specifications for boiler plate, rivet steel, steel castings, and steel forgings. (See 10O for reference to the A.S.M.E. Power Test Code which includes Boilers.)
- (d) See "Standard Specifications for Boiler Steel," adopted by the Association of American Steel Manufacturers, revised 1914, known as Manufacturers' Standard Specifications (1F3).
- (e) Cast Iron with respect to its use in boilers, radiators, etc., see publications of the American Foundrymen's Association, Inc. (1F1).
- (f) The American Uniform Boiler-Law Society exists for the purpose of promulgating the A.S.M.E. Code as the legal boiler construction code for all the states. It has now been made operative in nine states and eight municipalities. There has been published (87 pp.)
"Condensed Report of The American Uniform Boiler Code Congress," held under the auspices of the Industrial Commission of Ohio, December, 1916, and issued by the American Uniform Boiler-Law Society.
- (g) The National Boiler and Radiator Manufacturers' Association issues Part I, Section II, of the A.S.M.E. Boiler Code, which deals only with boilers for low-pressure steam- and hot-water heating and hot-water supply.
- (h) "Universal Safety Standards," Workmen's Compensation Bureau of New York, 1914. Contains section on Boilers, Valves, and Fittings.
- (j) "A Textbook of Engineering Thermodynamics," Charles Edward Lucke and John J. Flather. 688 pp., illus. Gives a numerical answer to the everyday problems of design and performance of heating, refrigerating, and power apparatus.
- (k) "Steam Boilers," E. M. Shealy. 374 pp.
- (l) For illustrations and description of Ideal Smokeless Down-Draft Boilers, see page 177 in Industrial Section of American Radiator Company.
- (m) For illustration, table of tests, and other information on Mills Water Tube Boiler, see page 179 in Industrial Section, of The H. B. Smith Company.
- (n) Inspection and Testing of Steam Boilers, see information on page 144 of the Industrial Section, by Robert W. Hunt & Company

10C3 Rating and Testing of House-Heating Boilers

[NOTE.—House heating is the term applied to all boilers not used for power and does not apply merely to residences.]

- (a) In "History, Aims and Achievements" issued 1916 by the N.A. of M.S. and H.W.F. (10A4), it is stated: "About the year 1909 this Association first took up with the manufacturers the question of a proper and uniform rating of house-heating boilers. Later on the A.S. of H. & V. E. joined in the negotiations, with the result that today the National Boiler and Radiator Manufacturers' Association has an accepted basis for the rating of house-heating boilers."
The commonly accepted method of rating has been on the basis of the amount of radiation which it is claimed a given size of boiler will serve. Much has been written and said on this subject.
- (b) See "The Testing of House-Heating Boilers" in the *Heating and Ventilating Magazine*, December, 1916, by L. P. Breckenridge and D. B. Prentice, as presented before the A.S.M.E. In this it is stated that "originally the foot of radiation meant a square foot of radiating surface, but improvements in design and arrangement enabled manufacturers to secure this condensation with less surface, and consequently less iron. The result has been a variable and decreasing value in square inches for the 'foot of radiation.' In fact, the unit has become, as it should, dependent entirely on condensation of steam, which means a heat transfer, rather than on any particular area of metal."

The authors propose, therefore, the following definition of a unit for stating the capacity of radiators and heating boilers: The "foot of radiation" shall be a quarter of a pound of steam condensed from and at 212° F. per hour.

- (c) See, also, discussions which followed this paper, printed in March, 1917, issue of this same magazine.
- (d) In a letter to the Editor from a prominent manufacturer of boilers, connected with an important association, it is stated:
"If the American Institute of Architects could bring about the establishment of a standard method of rating heating boilers it would mean a great step forward in boiler manufacturing.
"Practically every boiler manufactured today, no matter what its catalog rating, will actually develop its catalog rating, but the manufacturer does not tell how it has to be handled to develop its rating. Some boilers, to deliver their rating, have to be fired every four hours with a draft so intense that it almost equals a forced draft, so great is the rate of combustion per square foot of grate. Such a condition, of course, is not reasonable for a heating plant, and the only way to eliminate it is to surround the definition of how a boiler should be rated with certain safeguards."

Amount of Heating Surface Required on House-Heating Boilers

"For maximum economy with any kind of fuel, a boiler should be proportioned so that at least one square foot of heating surface should be given for every 3.45 pounds of water to be evaporated from, and at 212° F. per hour.

"For each 100 square feet of standard direct cast-iron radiation in still air, or its equivalent, 7.25 square feet of heating surface should be used, or that each square foot of heating surface in heater take care of 13.8 square feet of standard direct cast-iron radiation or its equivalent, which is 3.45 pounds of water per hour from and at 212° F.

"The above figures are based on the calculation that for each square foot of direct radiation, $\frac{1}{4}$ pound of water is condensed per hour from and at 212° F. The heating surface is as recommended by the American Society of Mechanical Engineers.

"Due to the wide difference in coal, it is impossible to specify the exact ratio of grate to heating surfaces, but the following will cover the situation.

Grate Area

- "That a grate area or its equivalent be furnished so that a firing period of not less than eight hours may be obtained."
- (e) The A.S. of H. & V. E. has a Committee on "Code for Testing Low-Pressure Heating Boilers" and is working on this subject. (See 10C4.) In its *Journal* and "Transactions" will be found many interesting and valuable contributions, some of these, issued as reprints are:
 1. "Testing and Rating House-Heating Boilers," Wm. Kent. 1909. 10 cents.
 2. "Standards and House-Heating Boilers," Report of Committee. 1910. 10 cents.
 3. "Basis for Rating House-Heating Boilers," F. L. Busey. 1911. 10 cents.
 4. "Definition of a Unit of Heat," R. P. Bolton. 1912. 10 cents.
 5. "Code for Testing House-Heating Boilers," Report of Committee. 1913. 10 cents.

10C4 Heating in General

(See 6J for Heating by Electricity and 7J for Heating by Gas.)

- (a) The following Pocket Books and Handbooks, which cover the whole range of this issue, will not be referred to again under the subjects into which this issue has been subdivided. Other publications or articles devoted principally to those subjects are separately listed.
 1. "Mechanical Engineers' Pocket Book," William Kent. 1916.
 2. "Mechanical Engineers' Handbook," Lionel S. Marks. 1916.
 3. "Architects' and Builders' Pocket Book," Frank E. Kidder. 1916.
- (b) The following books contain information on many of the subjects treated in this issue:
 1. "Civil Engineers' Pocket Book," J. C. Trautwine. 1913.
 2. "Fire Prevention and Fire Protection," J. K. Freitag. 1912.
 3. "Crosby-Fiske Handbook of Fire Protection," fifth edition.
 4. "I.C.S. Handbooks," and books included in Index to International Library of Technology.
- (c) See "Review of Current Technical Literature" and *Journal* of the A.S.M.E. for information on all phases of this subject. Also reports of committees in that Society. See, also, Standards recommended in reports of committees received by the Council of the A.S.M.E. as follows:

On Standard Tests and Methods of Tests, covering, among other things, the subject of testing of steel.

(d) See "Proceedings" of the A.S.C.E. for lists of "Current Engineering Literature."

(e) The A.S. of H. & V.E. is conducting investigations to determine the relative efficiency of a heating plant during the different periods of the heating season, dividing it up into periods of twenty days for each period and considering a heating season as 160 days, more or less, the first ten days and the last ten days being considered as one period and so on; this will determine the efficiency of the plant at slow, medium, and maximum combustion, and thus determine the relative efficiency of each rate of combustion from a number of such tests.

Through committees and in cooperation with other organizations, it is considering problems affecting all phases of heating.

The A.S. of H. & V.E. issues these reprints of papers:

1. "Design of Indirect Heating Systems—Maximum Economy and Operation," F. L. Busey, and W. H. Carrier. 1913. 20 cents.
2. "Heating and Ventilating of Federal Buildings," N. S. Thompson. 1910. 10 cents.
3. "Development in Heating and Ventilating Industrial Buildings," E. L. Hogan. 1915. 10 cents.
4. "Office Practice in Estimating Heating and Ventilation," J. D. Small. 1912. 10 cents.
5. "Heating a Swimming-Pool," C. Teran. 1912. 10 cents.
6. "Report of Committee on Steam Heating Residences," 1910. 10 cents.
7. "Hot Water Heating System of Crane Co., Chicago Works," F. E. McCreary.

(f) See the following in the *Heating and Ventilating Magazine*.

1. "Notes on the Rise of the Smokeless Boiler." October, 1916.
2. "Relative Economy of Heating by Steam at Different Pressures," A. Bement. February, 1917.
3. "The Care of a Vacuum Heating System in the Summer Months." August, 1917.
4. "A Survey of Operating Costs in Thirteen School Buildings," Jamestown, N. Y., J. M. Cushman. November, 1916.
5. "The Comparative Effects of Wind and Sunshine on Buildings," D. B. Prentice. June, 1916.
6. "Fuel Economies in House Heating," H. R. Johnson. December, 1916.
7. "Failure to Heat Premises—Tenant's Remedy." February, 1916.
8. "An extensive Open-Tank Gravity Hot Water Heating System," George Stumpf, Jr. October, 1914.
9. "Hot Water Heating on a Large Scale," New York State School of Agriculture, November, 1915.

(g) "Lefax" issues, among others, the following data sheets:

1. "Heating," from "Mechanical Equipment of Federal Buildings," N. S. Thompson, Chief Mechanical and Electrical Engineer, Supervising Architect's Office. (3-52.)
2. "Design of Steam and Hot Water Heating Systems," M. William Ehrlich. (4-96.)

(h) See "Mechanical Equipment of Buildings," a reference book for engineers and architects, by Louis A. Harding and Arthur C. Willard.

1. Volume I: "Heating and Ventilation." A reference book for architects and engineers. 1916. 619 pp. The authors have found it necessary, in their own experience, to make extensive use of manufacturers' data in designing the various mechanical systems or plants required in modern buildings. They have therefore not hesitated to include such data in the text, in order to illustrate and facilitate the design of similar systems in each subject treated.

2. Volume II: "Power Plants and Refrigeration."

(j) "School Architecture," W. G. Bruce. Fourth edition. For architects and school authorities. Chapter on Heating and Ventilating treats most of the subjects in this issue.

(k) "Handbook for Heating and Ventilating Engineers," James D. Hoffman. With tables and charts, on design and installation, widely used in colleges.

(l) "The Heating and Ventilating of Buildings," Rolla C. Carpenter.

(m) "Manual of Heating and Ventilation," F. Schumann.

(n) The Mechanical Equipment of Federal Buildings under Control of The Treasury Department, N. S. Thompson, has chapters on:

- I. Heating and Ventilation. II. Commercial Practice in Regard to Heating Factory and other Buildings. III. Commercial Practice in Regard to Heating by forced Circulation of Hot Water from a Central Station.

(See, also description under 6L.)

This book, written by the Chief Mechanical and Electrical Engineer, office of Supervising Architect, is especially interesting as an exemplification of the practice in that office and contains, besides data elsewhere referred to, discussions on general practice, schedules of piping sizes, sample specifications of the office, estimating data for apparatus in new federal buildings, ducts, flues, tables, and other information applicable to all features of heating and ventilating in all kinds of buildings.

(o) "Heating and Ventilating Plants," Charles L. Hubbard. Covers heating and ventilation as applied to all classes of buildings, from the small, furnace-heated dwellings to structures of the largest size. 300 pp., illus.

(p) "Heating and Ventilation," C. L. Hubbard. A practical manual of hot-air, steam and hot-water heating, and of modern systems of ventilation. 256 pp., illus.

(q) See "Heat Engineering," Arthur M. Greene, Jr.

(r) "Notes on Heating and Ventilation," Prof. John R. Allen. A résumé of lectures delivered to classes in heating and ventilation at the University of Michigan. 272 pp.

(s) "Mechanical Equipment of School Buildings," Harold L. Alt. 112 pp., illus. Contains Chapters as follows (other Chapters referred to elsewhere):

- I. Heating and Ventilating. II. Ducts and Flues. III. Heating and Ventilating Special Rooms. IV. Ventilating Toilets and Laboratories. XIV. The School Power Plant. XVIII. Vacuum Cleaning.

(t) "The Ventilation, Heating and Management of Churches and Public Buildings," J. W. Thomas. 148 pp., illus.

(u) "Modern Theater Construction," Edward Bernard Kinsila. Contains information on Heating and Ventilation.

(v) "Heating by Hot Water, Ventilation and Hot-Water Supply," Walter Jones. 360 pp., illus.

(w) "Hot-Water Heating and Fitting," William J. Baldwin. 306 pp., illus.

(x) "Warming Buildings by Hot Water," Frederick Dye. 319 pp., illus.

(y) "Practical Steam and Hot-Water Heating and Ventilation," Alfred G. King. Contains rules, tables, and 300 illustrations, showing in detail all the various heating systems, with pipe, radiator, and boiler connections.

(z) "Steam Heating for Buildings," Wm. J. Baldwin, M. Am. Soc. C. E. Descriptive of steam heating apparatus for warming and ventilating large buildings and private houses. 404 pp., illus.

(aa) "Heating by Steam and Hot Water," Charles B. Thompson. Has short rules for computing radiation, heat-losses, charts, illustrations, and descriptions of how best to heat water for baths, swimming-pools, etc. 265 pp., illus.

(bb) The Engineering Experiment Station of the University of Illinois issues:

1. "The Economical Purchase and Use of Bituminous Coal for Heating Homes." A new bulletin. 2. A circular on the installation of a house-heating system, showing the most economical methods of firing soft coal and operating a house-heating plant.

(cc) See "Building Code" recommended by the N.B. of F.U., 1915. Part XXVI, pp. 173-184, entitled "Chimneys, Flues and Heating Apparatus," contains Sections 178-185 on Chimneys, Smoke-Flues, Gas-Flues and Fireplaces; Smoke-Pipes; Heating Furnaces and Appliances; Stoves and Ranges; Hot-Air Pipes and Registers; Steam and Hot-Water Pipes; Vent-Flues and Ducts; and Dry Rooms. Includes diagrams.

(dd) See "Field Practice," Inspection Manual of the N.F.P.A., 1914. Contains sections as follows:

1. Sec. II: "Heating Hazards." Treats of Radiation and Conduction of Heat; Effect of Continuous Heat upon Heating Devices; Furnaces and Heating Devices of a Fixed or Stationary Type—Grading of Furnaces—Setting and Mounting—Clearance—General Features of Installation; Furnace Stacks, Chimneys and Flues, Breeching—Features of Installation; Hand or Movable Furnaces; Special Treatment of Miscellaneous Heating Devices; Common Miscellaneous Hazards, in connection with Use of Heat (including: Blower Systems for Heating, Ventilating, Stock and Refuse Conveying).
2. Sec. III: "Power Hazards, including Refrigeration." Treats of Steam Boilers; Electric Power—Electric Motors; Gas and Gasoline Engines; Fuel-Oil under Boilers and Furnaces, and for Domestic Use; Refrigeration.
3. Sec. VII: "Chimneys and Flues." Treats of proper construction of chimneys and flues and gives Instructions for Repairing Old Chimneys.

(ee) "A Handbook for Superintendents of Construction, Architects, Builders, and Building Inspectors," H. G. Richey. 357 pp. Superintendent of Construction, U. S. Public Buildings.

(ff) "Building Foreman's Pocket Book and Ready Reference," H. G. Richey. 1,118 pp., 656 figures.

STRUCTURAL SERVICE BOOK

(gg) See "The Building Estimator's Reference Book," Frank R. Walker. 1917. Contains a Chapter on "Steam and Hot Water Heating," pp. 3,200-3,207, which gives data for Estimating Steam and Hot Water Heating, Sizes and Costs of Boilers, Pipe and Fittings, Radiation and Bronzing.

(hh) **Principles of Heating**, Wm. G. Snow. 224 pp., illus.

(jj) "Firing Bituminous Coals in Large House-Heating Boilers," S. B. Flagg, Technical Paper No. 180, Bureau of Mines, 1917.

(kk) "Economical Use of Fuel in the Home," A. A. Potter and S. L. Simmering, Bulletin No. 8, Engineering Experiment Station, Kansas State Agricultural College, 1917.

(ll) See, also, Industrial Section, p. 177, American Radiator Company and p. 179, The H. B. Smith Company.

10C5 *Separate Letting of Contracts*

(See 9Ga for Resolution A.I.A. Convention, 1913.)

10D Warm-Air Heating, Stoves, Ranges and Dryers

1. The U. S. Department of Agriculture has issued Farmers' Bulletin No. 270, "Modern Conveniences for the Farm Home," 1916. 48 pp., illus. (Hydraulic and Sanitary features described under 9G37.) Gives a description of a hot-air furnace installation.
2. See "Saving Fuel in Heating a House," of the Bureau of Mines, listed under 10C1b. See, also, 10C4bb and 10C4kk.
3. The Federal Furnace League, which disbanded some five or six years ago, published, previous to that time, "The Warm Air Furnace," a handy reference book containing a compilation of rules and formulae to aid in estimating and installing warm-air furnaces. It was the official Handbook on warm-air furnace heating adopted by the National Association of Master Sheet Metal Workers. Cloth bound, 96 pp., including diagrammatic illustrations and tables.
4. The latest publication of this kind is: "Formula and Rules for Installation of Warm Air Heating" issued by the National Warm Air Heating and Ventilating Association (10A6). 1917. 10 pp. Contains Full Rule for Determining Heat Requirements; Rules for Pipe; Table of Pipe and Register Sizes; Results of Tests on Wall Pipe and Fittings; Directions and Rules for Cold Air Supply; Fresh-Air Room; Chimney Flues; Desirability of Shapes with Table of Sizes and a Short Rule for Determining Heat Requirements with table of Exposures and other tables.
5. The A. S. of H. & V. E. is gathering data from tests to determine the economic value of stoves for heating purposes. Tests will cover different rates of combustion and transmission at different temperatures to determine the actual value of these appliances for utilizing the heat in the fuel used.

Tests of hot-air furnaces will be conducted under the auspices of the Society to determine the best ratios for these appliances, in every particular, including the ratio of size of grate to flue area, ratio of grate to chimney area and height, the ratio of heating surface to grate surface, and the relative value of cast-iron or wrought-iron surfaces on different operations.

- Read the *Journal* and "Transactions" of the Society for current reports.
6. The following reprints of papers by the A. S. of H. & V. E. are of interest:
 - (a) "Engineering Data for Designing Furnace Systems," A. C. Willard. 1915. 10 cents.
 - (b) "Rational Methods of Warm-Air Heating," Roy E. Lynd. 1915. 10 cents.
 - (c) "Design of Furnace Heating Systems—10-Room Residence," J. D. Hoffman. 1909. 20 cents.
 - (d) "Hot-Air Furnace in Cellarless Houses," R. S. Thompson. 1908. 10 cents.
 - (e) "Report of Committee on Furnace Heating," 1910. 20 cents.
 7. See the *Warm Air Heating and Sheet Metal Journal*, monthly, National Association of Sheet Metal Contractors. (Serial No. 11.) Contains articles of interest on heating in general.
 8. "Furnace Heating," William G. Snow. A practical and comprehensive treatise on warming buildings with hot air. 259 pp., completely illus.
 9. **Progressive Furnace Heating**, Alfred G. King. A practical manual of designing, estimating, and installing modern systems. Supplemented by a treatise on construction and patterns of furnace fittings by W. Neubecker. 280 pp., illus.
 10. **The Furnaceman's Hand Book**, contains 58 pages of Practical, Simplified Rules and Tables for Warm-Air Furnace Heating, by M. H. Smith.
 11. "Drying Machinery and Practice," Thomas G. Marlow. A handbook on the theory and practice of drying and desiccating, with classified description of installations, machinery, and apparatus. 388 pp., illus.
 12. See "Heating of Water" (9F) for other information of collateral interest, and Industrial Section, p. 212, Humphrey Co., for heating of water by gas.

10E Blowers, Fans and Ventilation in General

(See the references under Heating in General (10C4), the majority of which contain sections covering the subjects included in this heading.)

1. The A.S.H. and V.E. is cooperating with biologists, physiologists, sanitarians, and psychologists to determine, if possible, whether the air in buildings is necessarily less healthful than the outer air, and if so, why. This work is covering a wide range of research and a thorough investigation into every phase of the subject. It is investigating the question of improvements in washing and conditioning the air to further improve the art of ventilation and is conducting experiments to standardize the various operations necessary to furnish adequate ventilation. Its committees are at work formulating requirements for ventilating buildings to guide the various state legislatures in making up codes for the regulation of such requirements in public and semi-public buildings.
2. See "Report of Committee on Minimum Ventilation Requirements for Public and Semi-Public Buildings for Legislation Purposes" of the A.S.H. and V.E. Contains General Suggestions on Compulsory Ventilation, applicable to all classes of buildings, and Special Minimum Heating and Ventilating Requirements applying to all Schools, Colleges, Factories, Work-rooms, Theatres, and Motion-Picture Houses. 23 pp.
3. Reprints of papers by the A.S.H. and V.E.:
 - (a) "Report of Committee on Blower Systems," A. M. Feldman. 1914. 10 cents.
 - (b) "Report of Committee on Fan Blast Heating (1)," 1909. 10 cents.
 - (c) "Report of Committee on School-room Ventilation," 1913. 10 cents.
 - (d) "New York State Commission on Ventilation—1915," Geo. T. Palmer. 1916. 20 cents.
 - (e) "Open Windows with Mechanical Ventilation," R. C. Taggart. 1912. 10 cents.
 - (f) "Ventilation of Telephone Booths," R. L. Douglass. 1914. 10 cents.
 - (g) "The Centrifugal Fan," F. L. Busey. 1915. 20 cents.
 - (h) "Report of Committee on Method of Taking Anemometer Readings," 1913. 10 cents.

4. See "Suggested Regulations of the N.B.F.U. for Blower Systems for Heating and Ventilating, Stock and Refuse Conveying as Recommended by the N.F.P.A." (3A32 and 3A34.) These have also been published in the *Heating and Ventilating Magazine* as Standard Heating and Ventilating Data Sheets, August, 1917.
5. "Ventilation Laws in the United States," published by the Heating and Ventilating Magazine Company. Contains Board of Health Requirements and Regulations of N.B.F.U., together with Model Ventilation Requirements as Promulgated by the A.S. of H. & V.E. 178 pp.
6. "Some Modern Methods of Ventilation," R. Grierson. 187 pp. With special reference to public buildings. Contains information for health authorities, architects, heating, sanitary and electrical engineers, sheet-metal workers, and others who may be called upon to install ventilating apparatus.
7. See "The Design of Blower Heating Systems for Factory and Shop Buildings," L. A. Harding and J. A. Moyer. Published by the Pennsylvania State College Engineering Experiment Station in Pennsylvania State College Bulletin, June, 1913. 60 pp.
8. **The Ventilation Hand Book**, C. L. Hubbard. 218 pp. and diagrams relating to Ventilation as applied to Furnace Heating; Ducts, Flues, and Dampers for Gravity Heating; Fans and Fan-work.
9. "The Ventilation of the School-room," Wm. J. Baldwin, M.E. 46 pp., illus.
10. "The Ventilation, Heating and Lighting of Dwellings," J. W. Thomas. Illus.
11. "The Fan," Charles H. Innes. 302 pp., illus. Includes the Theory and Practice of Centrifugal and Axial Fans, revised by W. M. Wallace and F. R. Jolley.
12. See "Motion-Picture Houses in New York City Inadequately Ventilated," *The Heating and Ventilating Magazine*, May, 1916.
13. For notes on "Air Cooling of Houses," from an address by Alexander Graham Bell in *National Geographic Magazine*, see The Builders' Guide of Philadelphia, October 10, 1917.

10E1 Duct Charts

(See, also, all references under 10L.)

- (a) "Tables for Ventilating Ducts," Chouteau E. Pearce, M.E., published on stiff cards by the Heating and Ventilating Magazine Company. These tables are useful in rapidly estimating superficial area and weights of galvanized sheet-

iron rectangular ducts, as usually employed in ventilating work. 50 cents.

- (b) "Chart for Figuring Round and Rectangular Ventilating Ducts," Chas. A. Fuller. *The Heating and Ventilating Magazine*, August, 1916.
- (c) See *Pipe Fitting Charts* (10J15) for section on Galvanized Iron Work, Weight of Ducts, etc.
- (d) See Pehl's *Everready Pipe and Elbow Chart*. 54 pp.

10F Air Conditioning, Temperature Control

Publications listed under Heating in General (10C), but especially many of those in the preceding subdivision on Ventilation in General will be found to treat of these subjects.

1. These are also embraced within the activities of the A.S. of H. & V.E. in connection with Ventilation investigations, and in the Report of the Committee on Minimum Ventilation Requirements it is stated:
"Temperature control, preferably of an automatic type, shall be required for all heated and ventilated rooms. The temperature regulator, whether by automatic or hand control, shall be so arranged that its operation will not decrease the required volume of air-supply for ventilation."
2. The A.S. of H. & V.E. is investigating to determine the best method of dust prevention and humidifying the air from furnaces, and to regulate or control the same. Also to test and determine the value of temperature-controlling devices for hot-air apparatus.
3. The following reprints of papers by the A.S. of H. & V.E. are of interest:
 - (a) "Report of Committee on Air Washers." 1910. 10 cents.
 - (b) "Preliminary Report of Committee on Standardizing the Testing of Air Washers," A. E. Stacey, Jr. 1914. 10 cents.
 - (c) "Humidity in Relation to Heating and Ventilation," L. C. Soule. 1912. 10 cents.

- (d) "Improved Air Conditions in a Boston Residence," F. I. Cooper. 1913. 10 cents.
- (e) "Studies in Air Cleanliness," G. C. Whipple and M. C. Whipple. 1915. 10 cents.
- (f) "Problem of City Dust," R. P. Bolton. 1915. 10 cents.
- (g) "Temperature Equivalents of Wind Velocities," H. W. Whitten. 1912. 10 cents.
4. See *Heating and Ventilating Magazine*:
 - (a) "New Ideas in Air Conditioning," W. E. Watt. February, 1916.
 - (b) "Air Conditioning for Factory Offices." May, 1917.
 - (c) "Tests of Air Conditions in an Illinois School," E. V. Hill, M.D. May, 1916.
 - (d) "Heating and Ventilation of School Buildings." Washed recirculated air compares favorably with fresh air. September, 1916. (See, also, correspondence, October, 1916.)
 - (e) "A Simple Method of Figuring the Economy of Humidity." May, 1917.
 - (f) "Fuel Economy with Increased Humidity." March, 1917.
 - (g) "Humidity and Automatic Control," Harold L. Alt. July, 1916.
 - (h) "Re-establishment of Temperature Control on a central Station Hot Water Plant." April, 1917.
5. The literature of manufacturers of these specialties will usually be found to go fully into details.

10G Natural Ventilation

This term is used to differentiate between forced ventilation and that of skylights and continuous sash and of those forms of metal ventilators used to accelerate and accomplish ventilation without other mechanical accessories. These will also be referred to in Serial No. 11 under Metal Products.

1. Attention is directed, however, to the following information in the Industrial Section especially prepared for presentation in connection with Ventilation.
 - (a) Specifications for and illustration of Swartwout Rotary Ball-Bearing Ventilators with reference made to Ventilation Data Card published by The Ohio Blower Company, p. 178.

- (b) For description and illustrations of Ventilating Gas Radiators Hawkes System, see p. 176, Hugo Mfg. Co.
- (c) For notes on Ventilation of Mausoleums, see p. 203, Presbrey-Coykendall Co.
- (d) For reference to the "Star" Ventilator, see p. 224, Industrial Section, Merchant & Evans Co.
2. "Natural Ventilation in the Federal Hill School," Harold L. Alt, in the *Heating and Ventilating Magazine*, June, 1916.
3. See, also, references under 10L "Metal Work," and many of those under 10E "Ventilation in General."

10H Chimneys, Flues, and Fireplaces

In the design of these, efficient proportions and construction tightness should be the first considerations, as a protection against fire and to afford a proper draft. The successful operation of any installation may be greatly impaired, if not entirely defeated, by inadequate size or lack of tightness in the joints of the flue.

The N.F.P.A., and the N.B.F.U. have issued valuable illustrated literature on the subject. Drawings and descriptions are to be found therein and in many of the handbooks and other publications heretofore listed, as follows:

1. Terra Cotta, Hollow Tile and Brick (3D).
2. Walls, Chimneys and Flues (4C).
3. The Suggested Municipal Ordinance for Regulating Fire Hazards of the N.F.P.A., entitled "Chimneys and Flues, to Provide for the Safe Construction of Chimneys, Flues and Fireplaces" listed under 3A3c1 and the recommendations of the N.B.F.U. for chimneys and flues in;
4. "Dwelling Houses—A Code of Suggestions for Construction and Fire Protection (3A4d3) will also be found printed and illustrated with line constructional drawings in;
5. "Clay Products for Building Construction" issued by The Sewer Pipe Manufacturers' Association (9B7c); also describes and illustrates fire-clay flue-linings and chimney-tops.
Valuable data for calculating the area, height, design, erection, and successful use of chimneys and flues will be found in many of the publications listed under Heating in General and Hot-Air Heating and in some of the handbooks and literature of manufacturers who are alive to the necessity of providing adequate draft as a precedent to satisfactory operation of any plant.
6. The A.S. of H. & V.E. proposes experiments to determine a standard for the size and height of chimneys and the strength of draft needed for a given operation; the value of round and square

chimneys; the relative efficiency of smooth tile-lined flues compared with the ordinary brick flues; the effect on the draft of diving and underground flues, the friction and heat-loss necessary to overcome the extra travel; the explanation in a practical manner of the laws governing drafts in chimneys and for formulating a standard method of building chimneys to prevent defective drafts.

7. Read "Chimneys: Their Design and Construction," by Harold L. Alt, in the *Heating and Ventilating Magazine* for March and April, 1917. Mentions common errors in chimney work, describes the use of draft gage and methods to obviate chimney leakage, gives recommendations for construction, making connections and a table for calculating sizes of flues for residences in proportion to cubical contents of building. Contains illustrations and table of commercial sizes and areas of flue tile. Gives designing data for chimneys and power plant stacks, frictionless charts for brick and steel stacks, and a theoretical draft chart for stacks.
8. "Chimney Design and Theory," W. W. Christie. A book for engineers and architects. 200 pp., illus. Contains Formulas; Tables; Wind-Pressure; Flues; Lightning Protection; General Information.
9. "Chimney Design," edited from various sources, by Walter Loring Webb, C. E. "Lefax" Data Sheet No. 4-106.
10. See *Heating and Ventilating Magazine*:
 - (a) "Things to Remember about Chimneys," E. C. Molby. October, 1916.
11. "The Ideal Fitter" of the American Radiator Company gives, in connection with each boiler described and illustrated, the size and height of chimney flue required. It also contains "Notes on Chimney Flues" with a table of commercial sizes of tile and unlined brick flues.

10J Pipes, Valves and Fittings

1. The A.S.T.M. has adopted "Standard Specifications for Welded Steel and Wrought Iron Pipe," Serial Designation A-53-15.
2. See Navy Department: Specifications 10C1d and Standards of Water Works Associations, The American Gas Institute, and other Standards which have been referred to under different subdivisions in previous issues, including Sprinkler Equipments (4F3c).
3. Tests, reports and discussions on the treatment and corrosion of iron and steel in pipes will be taken up in the next Serial Number (11), under Metal Products.
4. A.S.M.E. Standards recommended in reports of committees received by the Council of the Society and separately published on:
 - (a) Standard pipe, pipe-threads and pipe-unions.
 - (b) Identification of power-house piping.
 - (c) Standard threads for hose-couplings.
 - (d) Standardization of pipe-thread gages.
 - (e) The American Standard for pipe flanges, fittings, and bolting.
5. The National Association of Master Steam and Hot Water Fitters issues:
 - (a) The 1915 U. S. Standard Schedule of Flanged Fittings and Flanges, on which is stated: "The dimensions of the 'American Standard' are identical with the above, and this Schedule was adopted March 20, 1914, by a joint committee of this Association, the A.S.M.E., and the Committee of Manufacturers on Standardization of Fittings and Valves." Card-board. 24 x 35 inches. \$1.
 - (b) The same as a Chart, 9 x 12 inches.
 - (c) A folder giving separate schedule of the "Standard" flanges and "extra heavy" flanges.
6. The N.F.P.A. prints in "Proceedings":
 - (a) Reports of Committee on Standardization of Pipe and Pipe Fittings.
7. The A.S. of H. & V.E. has issued Reports of Committee on Corrosion in pipe, which will be referred to in next issue, and is now collecting data relating to sizes of pipes used in steam- or water-heating plants; will tabulate such data that the sizes needed for any part of a plant will be readily understood, and continue experiments to add what data may be needed to complete the subject.
8. "Dimensions and Weights of Pipe and Fittings," compiled by the Editors of *Power*. Covers all standard pipes and their fittings.
9. See "Lefax" Data Sheets, as follows:
 - (a) "Economic Design of Steam Piping," A. Langstaff Johnson, Jr.
 - (b) "Resistance of Pipes to Internal and External Pressure," K. F. Adamson.
10. "The Friction of Water in Iron Pipes and Elbows," paper by F. E. Giesecke, of the University of Texas, read before A.S. of H. & V.E., July, 1917.
11. See *Heating and Ventilating Magazine*:
 - (a) "Pipe Symbol Chart," T. W. Reynolds. February, 1916.
 - (b) "A Handy Chart for Determining the Weight of Pipe," W. F. Schaphorst. March, 1917.
 - (c) "Pipe Hangers," Harold L. Alt. March and April, 1916.
 - (d) "A British Tribute to the Superiority of American Pipe," October, 1916.
 - (e) "Importance of Supervising Piping in Customers' Buildings," D. E. Karn, of Consumers' Power Company, Grand Rapids, Mich. August, 1917.
12. "A Handbook on Piping," Carl L. Svensen. 350 pp., illus. Has convenient information and data on piping, fittings, pipe joints, valves, piping drawings, pipe lines, and their accessories.
13. "Pipes and Piping," Hubert E. Colling. Included in the contents are: Steam-pipe conduits; pipe fittings; sizes of pipe; how to distinguish steel from iron pipe; a color scheme for pipe lines; effect of superheated steam on cast-iron valves and fittings.
14. "The Design of Valves for Use in High Class Buildings," M. W. Link. Paper No. 172 in the *Journal of the Society of Constructors of Federal Buildings*, March, 1915, pp. 133-142.
15. *Pipe Fitting Charts*, Wm. G. Snow. 284 pp., 220 figures of piping and apparatus for hot-water, steam, and other types, including ducts.
16. For data on Inspection and Tests of Pipe, Valves and Fittings, see the information concerning such services printed on pp. 142-144 in the Industrial Section by Robert W. Hunt & Company.
17. For reference by A. M. Byers Company to book on pipe issued by that Company, see Industrial Section, p. 225.

10K Radiators, Registers and Grilles

For many references to these subjects see other divisions, particularly Heating in General (10C) and Hot Air Heating (10D).

1. The A.S. of H. & V.E. has special committees, to Determine the Most Effective Place for a Radiator in a Room and to Recommend a Standard Method of Testing Radiators. Investigations are being conducted to determine:
 - (a) The relative value or ratio of one-, two-, three- and four-column radiators;
 - (b) the relative value or ratio of different heights of radiators from 18 to 45 inches;
 - (c) the effect of painting, bronzing, or enameling radiators;
 - (d) the loss in efficiency when the radiator is enclosed in a recess with only the front exposed, with the front covered with a grill, with the radiator all enclosed with only an opening at the bottom for air and a register in the top of the enclosure, to determine the size of openings at the bottom and size of register at top in proportion to the surface in the radiator;
 - (e) the ratio of efficiency of a window radiator enclosed under a seat;
 - (f) the ratio of fresh-air inlet and warm-air outlet per square foot of indirect surface;
 - (g) the ratio of register to indirect surface, to determine the frictional resistance of the ornamental face of a register.
2. The following reprints of papers by the A.S. of H. & V.E. are of interest:

(For treatments and coatings, see 12C)

- (a) "Wall Radiators vs. Long Pipe Coils," J. A. Donnelly. 1906. 10 cents.
 - (b) "Effect of Painting Radiating Surfaces," J. R. Allen. 1909. 10 cents. (See, also, 12C13.)
 - (c) "Determining Volume of Air Passing through Register," J. H. Kinealy. 1897. 10 cents.
 - (e) "Comparison of Pipe Coils and Cast-Iron Sections for Warming Air," Prof. J. R. Allen. Contains tests demonstrating that condensation for both types of surface depends upon friction of air through the heater.
3. See *Heating and Ventilating Magazine*:
 - (a) "Determination of Radiator Sizes for Hot Water Heating Plants," Freywid Wegelius. January and April, 1916.
 - (b) "Best Position for a Radiator in a Room," September, 1916.
 - (c) "Requirements for Radiator Humidifiers," E. P. Lyon. August, 1917. Contains description of a new type capable of evaporating 2.9 gallons per sq. ft. of hot water radiator per day.
 - (d) "Apparatus for Testing Heat Transmission from Radiators," May, 1916.
 4. For Ventilating Gas Radiators, see Industrial Section, p. 176, Hugo Mfg. Co.

10L Metal Work, Ducts, Chase Lathing

See especially the references to Warm-Air Heating, Ventilation, Indirect Heating and the Section on Duct Charts (10E14) and the reference to *The Warm-Air Heating and Sheet Metal Journal* (10D7).

1. See *Heating and Ventilating Magazine*:
 - (a) "Practical Sheet Metal Duct Construction," William Neubecker. July, 1916.
 - (b) "Standard Practice for Sheet Metal Work in Ventilating Systems," T. W. Reynolds. December, 1916.
 - (c) "Comparison of various methods of Figuring Duct and Flue Sizes," Harold L. Alt, October, 1916.
2. Of the publications under 10E, see particularly "The Ventilation Handbook" (10E8) as a complete exposition of the metal work features pertaining to all forms of heating and ventilating.
3. See, also, "Sheet Metal," the publishers of which also publish:
 - (a) "Practical Sheet Metal Duct Construction," W. Neubecker. 194 pp., diagrams.

(See, also, 11B5 and 12C)

- (b) "Practical Exhaust and Blow Piping," W. H. Hayes. 160 pp., illus.
 - (c) "Elbow Patterns for all Forms of Pipe," F. S. Kidder. 73 pp., 35 figures.
4. See, also, *The Sheet Metal Worker*.
 5. For notes on steel and iron base of galvanized sheets, see 11B50.
 6. For important data in connection with the painting of galvanized metal, see 11B5p, 12C1, and 12E9.
 7. For the Painting of Tin, see, also, same references as well as 11D24 and Industrial Section, p. 146.
 8. Furring and plastering over heat-pipes and ducts in chases, halls or partitions. The importance of using metal as a protection against fire is evident. For data on Metal Lath, see Industrial Section, pp. 162-167.

10M Air-Leakage, Guarantees and Formulas

1. In an address before the N.A.M.S. and H.W.F. in June, 1916, the Editor of the S.S.D. said:
"Can you not, in coöperation with the A.S. of H. & V.E., work on developing a basic formula, or officially approving one of those in existence, for computing the amount of radiation recommended in proportion to cubical contents, to outside wall area (for different kinds of walls and different exposures), to window and door openings, etc., and make this available to all architects for instant reference?"
Several formulas have been put forth for calculating the amount of radiation required to heat given spaces under varying exposures, but until of late years not much data was obtainable with respect to transmission of heat and other factors affecting the materials of construction.
2. One that has been largely used was promulgated by John H. Mills in his work "Heat" published over twenty years ago. Others in use known as Carpenter's, Thompson's, or Holbrook's formulas will, with others offered by various authorities, be found in the references under Heating in General.
3. C. B. Thompson, in a pamphlet published in 1909, entitled "Heat Transmission," completely discusses the subject and offers his formula, giving a chart for ready use, with an accompanying diagram for making quick calculations.
4. Particular attention is directed to the complete and extensive tables and formulae, based on Professor Woodbridge's calculations, in "The Mechanical Equipment of Federal Buildings" (10C47), being the Basis for Calculating Radiating Surface used in the office of the Supervising Architect, Treasury Department.
5. See next following Section on Heat Transmission for activities of the A.S. of H. & V.E., which will have an important bearing on developments of formulas.
6. With respect to performance affecting guarantees, the A.S. of H. & V.E. is conducting investigations to determine what constitutes a standard performance of a steam- or water-heating apparatus and to determine a standard method by which any heating apparatus may be tested in any weather at or below 50° F. that will be equivalent to a performance of 70° inside in zero weather, or below.
7. "Heat Loss from Buildings and How to Reduce It," *Engineering and Contracting*, March 28, 1917. An editorial advocating and describing the double glazing of windows.
8. See "Lefax" Data Sheets, as follows:
"Calculating Heat Losses from Buildings," Charles L. Hubbard. From *Power* (4-158), May 19, 1914.
"Cubical Contents of Rooms" (5-346). Giving tables for instantly calculating same.
9. Experiments to determine the relative heat lost through single- and double-glazed wood, steel and hollow metal sash have been conducted recently under the direction of A. N. Sheldon. In a paper before the A.S.M.E., printed in January, 1917, "Proceedings," Mr. Sheldon gives the results of his tests.
10. In Bulletin of Building Data League, (2A5d) April, 1916, is printed the results of tests, entitled "The Leakage of Air through Windows," initiated and directed by Mr. Stephen F. Voorhees, with apparatus purchased by the New York Telephone Co. The general results are given in relative form only, as further tests are in progress to determine absolute values, if possible. The results show how serious the leakage of air may be.
11. See Reprints of papers by the A.S. of H. & V.E.:
(a) "Formula for Radiation for Hot Water Heating," Jas. A. Donnelly. 1914. 10 cents.
(b) "Effect of Wind on Heating and Ventilating," H. W. Whitten. 1909. 10 cents.
(c) "Performance of Heating Guarantees," Wm. Kent. 1910. 10 cents.
(d) "Report of Committee on Heating Guarantees." 1912. 10 cents.
(e) "Window Leakage," Stephen Voorhees and Henry C. Meyer, Jr. 1916.
12. See *Heating and Ventilating Magazine*:
(a) "Contractor's Guarantee of Heating Installations." January, 1916.
(b) "Contractor's Guarantee for Heating System." August, 1916.
13. See "The Control of Air Leakage Around Windows," H. McGeorge, in *Furnace Heating* (10D8) pp. 237-246.
14. **Metal Weather Strips.** Building Data League conducted investigations and issued "Preliminary Specifications and Notes," September, 1916, for discussion among members.
15. It is of especial interest to note that in the calculations of the office of the Supervising Architect (10M4) a different formula is used for buildings equipped with metal weather strip equal to about a 10 per cent reduction in the amount of radiation.

10N Heat Transmission, Insulation, Coverings

(See, also, 10M and 10O, as well as the Heating and Cooling of Water 9F).

1. The A.S. of H. & V.E. is collecting and tabulating data of all tests relating to heat-losses through building materials. It will collate the results of new tests till the heat-losses of all materials used in a modern building have been ascertained, and then maintain authoritative data for use as a basis in determining the heating surfaces necessary for buildings of various types.
It will collect data relative to the heat-loss through covering materials and make tests to verify them and determine the value of insulating materials used for insulating buildings, boilers, pipes, cooling pipes, cooling machinery, and other apparatus.
2. In an address before the N.A.M.S. and H.W.F. in June, 1916, the Editor of the S.S.D. then said: "In the matter of sectional covering and banding on lateral runs, plastic covering on flanges, couplings and fittings, and on the heating apparatus itself, surely some standards of practice could be developed which would greatly aid in establishing a uniform basis of estimating."
3. See "Specification for 85 per cent Magnesia Non-Conducting Coverings for Power and Heating Systems" (received March 8, 1917, but not dated), described in a letter, from Prof. Thomas Nolan, Chairman Committee on Materials and Methods, A.I.A., quoted under 4K2.
4. The Low Pressure Covering Manufacturers' Association has under consideration the recommendations of its Standard Committee for a specification on Air Cell and Wool Felt Covering. It is expected that specifications for the uniform proper application of such coverings will be given consideration later on.
5. See "List of Inspected Mechanical Appliances," published by Underwriters' Laboratories, for Heat Insulating Coverings and Pipe Coverings.
6. See "Mineral Resources of the U. S.," issued by U. S. Geological Survey, 1915, Part II, "Nonmetals," for Chapter on "Asbestos."
7. See "Practical Laws and Data on the Condensation of Steam in Covered and Bare Pipes," C. P. Paulding. To this is added a translation of Péclet's "Theory and Experiments on the Transmission of Heat Through Insulating Materials." 107 pp., illus.
8. See "Transmission of Heat Through Cold-Storage Insulation," C. P. Paulding. Formulas, Principles, and data relating to insulation of every kind. 41 pp., illus.
9. See Reprints of Papers by the A.S. of H. & V.E.:
(a) "Heat Transmission with Pipe Coils and Cast Iron Heaters," L. C. Soule. 1913. 10 cents.
(b) "Heat Losses through Building Materials," L. A. Harding. 1913. 10 cents.
(c) "Heat Losses and Heat Transmission," Walter Jones. 1906. 10 cents.
(d) "Heat Transmission through Building Materials," John R. Allen. August, 1916.
10. See *Heating and Ventilating Magazine*:
(a) "Government Experiments on Heat Transmission through Walls." September, 1916.
(b) "Effect of Velocity and Humidity of Air on Heat Transmission through Building Materials," J. A. Moyer. February, 1916.
(c) "The Heat Insulating Properties of Commercial Steam Pipe Coverings," L. B. McMillan. January, 1916.
11. The Bureau of Standards, in addition to several commercial tests, has been making investigations upon about twenty-five different kinds of materials, the samples being purchased in the open market. These include flax, asbestos, and cork products, and a wide variety of special materials. An investigation of the thermal conductivity of wood is in progress, several varieties having been measured. The very great importance of confined air-spaces in the construction of insulating walls led to an extended investigation of the laws governing heat transmission by confined air, which is being continued.
12. See "A Comparison of the Heat Insulating Properties of Materials used in Fire-resistive Construction" (8D21).
13. See, also, report of A.S.T.M. Committee C5 on "Fireproofing" for tentative standard time-temperature curve and Standards of the A.S.T.M. mentioned under 11D3b and c.

10 o Mechanical Equipment in General—Power Houses and Cold Storage Plants

Concerning the various features of same there is, in addition to the many publications already listed in this issue, such a vast array of literature that no attempt is now made to do more than mention a few of the books generally applicable and list some of the controlling factors.

10 O1 Information Obtainable.

- (a) For many features of Mechanical Equipment, see Serial No. 4, Fire Prevention and Protection; No. 6, Electricity; No. 7, Gas; No. 9, Hydraulics and Sanitation.
- (b) "Engineering of Power Plants," Robert H. Fernald and George A. Orrok. 1916. 596 pp., illus.
- (c) "Steam Power Plants," Charles L. Hubbard. 299 pp., illus.
- (d) "Combined Power and Heating Plants," Charles L. Hubbard. 408 pp., illus. Contents include: Power, heating, and ventilating requirements for different types of buildings; hot-blast heating and ventilation; central plants.
- (e) "Small Power Plants." See, "Mechanical Equipment of Federal Buildings," Chapter IX, described under 6L1j.
- (f) "Steam Power Plants," Henry C. Meyer, Jr. 219 pp., illus. Includes new data on chimneys.
- (g) "Heat and Thermodynamics," F. M. Hartmann. 346 pp., illus. Home study book, based on the course which the author gives at the Cooper Union Schools.
- (h) "Heat," E. M. Shealy. 265 pp., illus. Treats of the steam engine, gas engine, refrigerating machine, and air compressor. Elementary.
- (j) "Heat Engines," J. R. Allen and J. A. Bursley. 320 pp., illus. A book of practice (not design).
- (k) "The Method of the Future Central Station Heating," A. Williams. *Heating and Ventilating Magazine*, August, 1916.
- (l) "District Heating," S. M. Bushnell and Fred. B. Orr. 1915. A brief exposition of the Development of District Heating and its Position among Public Utilities. 290 pp., illus.
- (m) "Lefax" issues among others the following data sheets:
 1. "Central Station Hot Water Heating by Forced Circulation," Leon A. Warren. From "Mechanical Equipment of Federal Buildings" (6-264), N. S. Thompson.
 2. "Vacuum Cleaning in Large Buildings," Charles L. Hubbard. From *Practical Engineer* (4-111), March 15, 1914.
- (n) See "Vacuum Cleaners," described under 6K.
- (o) "Hydraulic Elevators," William Baxter, Jr. 300 pp., illus. Various makes of elevators fully described.
- (p) See "Electric Elevators and Dumbwalters," under 6F.

10 O1q Refrigeration and Cold Storage

See, also, Heat Transmission, Insulation, Coverings (10N), and for information on cooling of water, see 9F.

1. The American Association of Refrigeration issues:
 - (a) "Proceedings." Reports of committees, papers, and discussions.
 - (b) "Bulletins." Reports of investigations made by various committees and commissions of the Association.
 - (c) Translation in three languages of the entire Proceedings of the Third International Congress of Refrigeration is now in preparation.
2. Data pertaining to the publications of The American Society of Refrigerating Engineers not yet received.
3. See, "Mechanical Equipment of Federal Buildings," N. S. Thompson. (10C4n.)
4. See "Power Plants and Refrigeration," L. A. Harding and A. C. Willard. (10C4h2.)
5. "Refrigeration," Chas. Dickerman and Francis H. Boyer. A guide to the principles, details, and practice of modern systems of artificial cooling, including construction, equipment, and operation. 128 pp., illus.
6. "Pocket Book of Refrigeration and Ice-Making," A. J. Wallis-Taylor. A reference book on refrigeration and cold storage. illus.
7. "Refrigeration, Cold-Storage and Ice-Making," A. J. Wallis-Taylor. 590 pp., diagrams.
8. "A Practical Treatise on the Production of Low Temperatures as Applied to the Manufacture of Ice and to the Design and Operation of Cold Storage Plants," M. W. Arrowood. 1916. 290 pp., illus.
9. "The Elements of Refrigeration," A. M. Greene, Jr. 478 pp., illus. Contains, in logical order, data from which to design, construct and operate refrigeration apparatus.

10. "Elementary Mechanical Refrigeration," F. E. Matthews. 172 pp., illus. A treatise for the person who is not a specialist but needs concise working data.
11. "Principles and Practice of Artificial Ice-making and Refrigeration," L. M. Schmidt. 232 pp., illus. Comprises Insulation of Cold Storage and Ice Houses, Refrigerators, etc.
12. "Ice-Making Machines," M. Ledoux. The theory of the action of the various forms of cold-producing machines. 258 pp.
13. See "Air-Cooling and Refrigeration," being Notes on Air-Cooling Practice in *Heating and Ventilating Magazine*, May, 1917.
14. The Bureau of Standards is conducting extensive investigations, with the coöperation of committees of the American Association of Refrigeration and the American Society of Refrigerating Engineers. These investigations relate to ice, ammonia, brines, the thermal conductivities of insulating materials, and 10O1 continued, will form the subject of papers.
- (r) "Hand Firing Soft Coal under Power-Plant Boilers," Henry Kreisinger, Technical Paper No. 80 of the U. S. Bureau of Mines, 1916.
- (s) "Boiler-Room Economics," A. A. Potter and S. L. Simmering, Bulletin No. 2, Engineering Experiment Station of Kansas State Agricultural College.
- (t) See A.S.M.E. Condensed Catalogs of mechanical equipment with general classified directory and an engineering data section.
- (u) See Sweet's Catalogue, Engineering Edition, comprising Materials of Construction, Contractors' Plant and Power-Plant Equipment, indexed and cross-referenced, and containing Specification Digest and Checking List.
- (v) For data on Capacity and Efficiency Tests of Power Plants, and on Acceptance Tests of Power Plant Equipment, see the information concerning such services printed on pp. 142-144 in the Industrial Section by Robert W. Hunt & Company.

10 O2 Practice Recommended and Standards to be Followed

- (a) See the various publications of the N.F.P.A., the N.B.F.U. and A.F.M.F.I. Co. concerned with mechanical equipment as listed in the Journal for March, pp. 144-146, which includes:
 1. "Cold-Storage Warehouses: Suggestions for Their Improvement as Fire-Risks" (3A3d44).
 2. See, also, other recommendations of these authorities mentioned under Heating in General (10C).
 3. N.F.P.A. "Index" (3A3h5) contains references to Refrigeration and other forms of mechanical equipment.
- (b) See, also, the appliances and devices pertaining to Mechanical Equipment inspected and labeled by the Underwriters' Laboratories embraced within:
 1. List of Inspected Mechanical Appliances (3A6b).
 2. List of Inspected Electrical Appliances (3A6c).
 3. List of Appliances Inspected for Accident Hazard (3A6d).
- (c) See Bulletins of the American Association of Refrigeration (10O1q1a).
- (d) See Navy Department specifications (3A1a2) for "Refrigerators for U. S. Navy (except torpedo craft and tugboats)," Serial designation 12R6, March 10, 1913. Others mentioned under 10C1.
- (e) See "Boiler Standards" 10C2.
- (f) See "Pipes, Valves and Fittings" (10J) for the standards mentioned thereunder.
- (g) See Reports of Committees of the A.S.M.E., the A.S.H. and V.E., and others listed under various subdivisions.

10 O2h Power Test Code

1. The A.S.M.E. Power Test Code, entitled "Rules for Conducting Performance Tests of Power Plant Apparatus" is a new set of testing codes of the Society to replace those in force up to the present time, relating to boilers, pumping engines, locomotives, steam engines in general, and apparatus and fuels therefor, and extended so as to apply to such power-generating apparatus as the present codes do not cover, including water power, bringing them into harmony with each other and with the best practice of the day.

Serial No. 11

METAL, PLASTIC AND OTHER PRODUCTS

CONTENTS

Previous issues have dealt with all main structural features of a building; the last four issues have treated all forms of mechanical equipment; this issue treats of products and devices, the installation of which would occur at or about this stage of progress in the construction of a composite building. The wood trim and finish having been included in the wood issue, when lathing, plaster-

ing, metal windows, doors, trim, hardware, and other metal and plastic products, including roofing, have been treated herein, there will remain only the painting, finishing, and glazing to complete the structure. These, with miscellaneous items, will be covered in the December issue, or No. 12 Serial, which will also conclude the first year's review.

NOVEMBER, 1917

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11A Societies, Associations, and Allied Interests

The publications and activities of the following bodies and of any of the governmental departments concerned with matters affecting metal, plastic and other products treated, will be mentioned wherever possible in connection with the main subject heading or subdivision under which they would naturally fall.

1. AMERICAN SOCIETY OF CIVIL ENGINEERS
Secretary: Chas. Warren Hunt, 220 W. 57th Street, N. Y. City.
2. ILLINOIS SOCIETY OF ARCHITECTS
Secretary: John Reed Fugard, Harris Trust Building, Chicago, Ill.
3. WESTERN SOCIETY OF ENGINEERS
Secretary: Edgar S. Nethercut, 1735 Monadnock Block, Chicago.
4. ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Secretary: Elmer K. Hiles, 568 Union Arcade Bldg., Pittsburgh.
5. AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS
Secretary: Charles C. Brown, Wulsin Building, Indianapolis, Ind.
6. AMERICAN CHEMICAL SOCIETY
Secretary: Charles L. Parsons, Box 505, Washington, D. C.
7. AMERICAN INSTITUTE OF METALS
Secretary: W. M. Corse, 106 Morris Avenue, Buffalo, N. Y.
8. ARCHITECTURAL IRON AND BRONZE MANUFACTURERS
Secretary: W. A. Morrison, 331 Madison Avenue, New York City.
9. NATIONAL ASSOCIATION OF ORNAMENTAL IRON AND BRONZE MANUFACTURERS
President: H. H. Suydam, care of Cincinnati Manufacturing Company, Cincinnati, Ohio.
10. NATIONAL ASSOCIATION OF SHEET METAL CONTRACTORS OF THE UNITED STATES
Secretary: Edwin L. Seabrook, 261 S. Fourth Street, Philadelphia.
11. NATIONAL ASSOCIATION OF BRASS MANUFACTURERS
Chairman Standardization Committee: H. N. Gillette, Oliver Building, Pittsburgh, Pa.

12. NATIONAL ASSOCIATION OF MANUFACTURERS OF APPROVED HOLLOW METAL WINDOW FRAMES AND SASH
Secretary: Thomas Shean, 2799 Fifth Avenue, Chicago, Ill.
13. AMERICAN HARDWARE MANUFACTURERS' ASSOCIATION
Secretary: F. D. Mitchell, Woolworth Building, New York City.
14. NATIONAL RETAIL HARDWARE ASSOCIATION
Secretary: M. L. Corey Argos, Ind.
15. NATIONAL HARDWARE ASSOCIATION OF THE UNITED STATES
Secretary: T. James Fernley, 505 Arch Street, Philadelphia, Pa.
16. WOOD, WIRE AND METAL LATHERS' INTERNATIONAL UNION
Secretary: Ralph Grandt, 401 Superior Building, Cleveland, Ohio.
17. ASSOCIATED TILE MANUFACTURERS
Secretary: F. W. Walker, Beaver Falls, Pa.
18. GYPSUM INDUSTRIES ASSOCIATION
1611 Harris Trust Building, Chicago, Ill.
19. NATIONAL ASSOCIATION OF MASTER SLAG AND GRAVEL ROOFERS
Secretary: John A. Duroff, Drexel Building, Philadelphia, Pa.
20. ASBESTOS PAPER MANUFACTURERS' ASSOCIATION
Secretary: C. J. Stover, Bulletin Building, Philadelphia, Pa.

There is also record of:

21. AMERICAN ELECTRO-CHEMICAL SOCIETY
22. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
23. ASPHALT PUBLICITY BUREAU
24. SAND-LIME-BRICK ASSOCIATION
25. INTERNATIONAL UNION OF BRICKLAYERS, MASONS AND PLASTERERS

Other bodies, interested in the subjects now treated, have been mentioned under previous serial numbers, particularly under Nos. 1, 2, 3, and 4.

11B Metals and Metal Products**11B1 Metals in General**

Considerations here do not include Structural Iron and Steel, which were treated in Serial No. 1. Many of the publications listed there, however, are applicable here. See, also, Metal Products 11B5 and, also, Metal and Plastic Products, 11D.

For "Tests of Metals," Watertown Arsenal, War Department, U.S.A., see 1B1b.

- (a) See Proceedings of the A.S.T.M. (1A4a) for reports of the following committees, and for papers presented before conventions:
Cast Iron (A.S.T.M.: A3); Wrought Iron (A.S.T.M.: A2); Non-Ferrous Metals and Alloys (A.S.T.M.: B2).
- (b) See "Review of Current Technical Literature" and *Journal* of the American Society of Mechanical Engineers (10A1).
- (c) See index to list of Engineering Articles of Interest, and to papers and discussions, contained in each issue of the Proceedings of the American Society of Civil Engineers (11A1).
- (d) An investigation has been concluded of the initial stresses, cause of failure, and properties of structural brasses, an account of which is to be published as a technologic paper. (See e, below.) A great deal of this work has been materially aided by the co-operation of brass manufacturers and of users of brass, such as the Navy Department, the New York Board of Water Supply, the City of Minneapolis, the Panama Canal Commission, and others. It is expected that the results obtained will be serviceable in framing specifications for the use of structural brass. (From Report of Bureau of Standards, 1916.)
- (e) "Failure of Brass. 2. Effect of Corrosion on Ductility and Strength of Brass," Paul D. Merica. Technologic Paper No. 83, U. S. Bureau of Standards. 1916. 7 pp., illus. 5 cents.
- (f) "Manufacture and Uses of Alloy Steels," H. D. Hibbard. Bulletin No. 100, U. S. Bureau of Mines. 1915. 78 pp. 10 cents. A general statement on the composition and heat treatment of various steels, and their use for special purposes.
- (g) See "General Metallurgy," H. O. Hoffman. 999 pp., illus.
- (h) See "An Introduction to Metal-Working," J. C. Pearson. 1916. 126 pp., illus.
- (j) See "The Coloring of Non-Ferrous Metals and Alloys," Jerome Brandes. Lefax Data Sheet 7-278
- (k) See "The Story of Abrasives," *Iron Tradesman*, January, 1917.

11B2 Corrosion and Treatment of Metals

The references which follow are selected for consideration in connection with the proper use and care of metals quite independent of the various sections and articles which are part of the Pocket Books, Handbooks and other publications mentioned under 11D1g, which see. See, also, "Corrosion of Steel" (1F8a and 1F8f).

In connection with sprinkler pipe, see five N.F.P.A. references listed under 4F1f; also 4F1h; also, Pipes, Valves, and Fittings (10J).

See, also, "Corrosion of Pipes, Boilers, and Structural Work" (4F1g1); also Treatments and Coatings for Metals (12C).

- (a) "Structure of Coating on Tinned Sheet Copper in Relation to a Specific Case of Corrosion," P. D. Merica. Technologic Paper No. 90, Bureau of Standards. April 21, 1917. 18 pp. 5 cents.
- (b) "A Curious Case of Corrosion of Tinned Sheet Copper," P. D. Merica. Paper read before the American Institute of Metals, September, 1916. 12 pp., illus. Contains "Conclusions," by the Bureau of Standards.
- (c) See "Proceedings," A.S.T.M., for the following:
 1. "The Relative Corrosion of Wrought Iron and Steel," H. M. Howe, Vol. VI, p. 155, 1906.
 2. "The Relative Corrosion of Steel and Wrought Iron Tubing," H. M. Howe and Bradley Stoughton, Vol. VIII.
 3. "The Value of the Sulphuric Acid Corrosion Test," C. M. Chapman, Vol. XI, p. 609, 1911.
 4. "The Marked Influence of Copper in Iron and Steel on the Acid Corrosion Test," W. H. Walker, Vol. XI.
 5. Report of Committee A-5, A.S.T.M., on Corrosion of Iron and Steel, 1917.
- (d) "To Study Corrosion of Steel Imbedded in Gypsum and Concrete" (in connection with work of Committee A-5, A.S.T.M.). *Construction*, July, 1917.
- (e) "Methods of Testing the Durability of Pipe under Corrosion," F. N. Speller, Part II, "Technical Papers," A.S.T.M., 1916.
- (f) See "Proceedings" of the American Gas Institute (7A2a) for the following: (For quotations from 1, see 7E3d.)
 1. "Report of Committee on Gas House Piping," Vol. X.
 2. "The Installation and Maintenance of Services," R. B. Duncan, Vol. IX, 1914, p. 1052.
 3. "Proper Specifications for, and Inspection of, Interior Gas Piping," A. E. Turner, Vol. IX, 1914, p. 1311.
 4. "The Installation of Mains and Pipe Lines of Steel and Wrought Iron," H. L. Rice, Vol. VIII, 1913, p. 145.

- (g) "Relative Corrosion of Wrought Iron and Soft Steel Pipes," T. N. Thomson, "Proceedings," American Society of Heating and Ventilating Engineers, Vol. XIV, 1908.
- (h) See reprints of papers by the A.S.H. & V.E.:
 1. "The Prevention of Corrosion in Pipe," F. N. Speller. 1916. 10 cents.
 2. "Report of Committee on Corrosion in Pipes," 1909. 10c.
- (j) "The Relative Corrosion of Iron and Steel Pipe as Found in Service," W. H. Walker, "Proceedings" new England Water Works Association, 1911.
- (k) "Steel Pipe vs. Wrought Iron Pipe in Refrigerating Work," P. DeC. Ball, "Proceedings" American Society of Refrigerating Engineers, 1911.
- (l) "Structural or Mechanical Theory of the Effect of Rust on Cast Iron and Wrought Iron and Steel," R. C. McWane and H. Y. Carson. Paper before American Foundrymen's Asso.
- (m) See the following "Lefax Data Sheets":
 1. "Oxides and Other Coatings for the Prevention of Corrosion of Iron and Steel," L. C. Wilson, *Engineering Magazine*, February, March, and April, 1915. (5-286.)
 2. "Copper in Steel—Its Influence on Corrosion," D. M. Buck. 1913. (5-31.) Digest of paper read before American Chemical Society.
- (n) "Corrosion of Hot Water Piping in Bath-Houses," Ira H. Woolson, *Engineering News*, December 3, 1910, p. 630.
- (o) "Observations upon the Atmospheric Corrosion of Commercial Sheet Iron," E. A. Richardson and L. T. Richardson, *Metallurgical and Chemical Engineering*. Paper read before American Electro-Chemical Society, October 15, 1916.
- (p) "Corrosion in a Steel Gasholder Tank," William Wilson, *Journal of Gas Lighting*, London, England, September 12, 1916.
- (q) "Theory of the Corrosion of Steel," Leslie Aitchison, *Journal*, Iron and Steel Institute, Vol. 93. Illus.
- (r) "Influence of Carbon and Manganese upon the Corrosion of Iron and Steel," Robert Hadfield and J. N. Friend, *Journal*, Iron and Steel Institute, Vol. 93. Illus.
- (s) "The Corrosion of Metals," Wm. E. Bibbs, Richard H. Smith and Guy D. Bengough, *Mechanical Engineer*, May 5, 1916. Report to the Institute of Metals.
- (t) "Effect of Rust on the Rate of Corrosion," James Ashton, *Steel and Iron*, May, 1916. Paper read before American Electro-Chemical Society.
- (u) "Repairing Split and Corroded Pipe with an Oxy-Acetylene Welder," *Engineering-Contracting*, May 3, 1916. Illus.
- (v) "No Rust in Galvanized Steel Tower at Iloilo After Twelve Years," J. L. Harrison, *Engineering Record*, Jan. 6, 1917. Illus.
- (w) "The Design of Hot Water Supply Systems to Minimize Corrosion," F. N. Speller, *Engineering News*, Feb. 13, 1913.
- (x) "The Relative Corrodibilities of Iron and Steel," J. Newton Friend, "Proceedings" Faraday Society, London, Vol. XI.
- (y) In "Practical Steam and Hot-Water Heating and Ventilation," (10C4y), see Chapter VI., Alfred G. King.
- (z) In "American Stationary Engineering," W. E. Crane, see pp. 54-81.
- (aa) In "Modern Plumbing," R. M. Starbuck, p. 263 and following.
- (bb) "The Decay of Metals," Cecil H. Desch, *Scientific American Supplement*, September 16, 1916. From Transactions, Institute of Engineers and Ship-Builders in Scotland.
- (cc) "Physical and Mechanical Factors in Corrosion," Cecil H. Desch, *Scientific American Supplement*, May 6, 1916. Paper read before the Faraday Society.
- (dd) "Electrolytic Corrosion of Iron in Concrete," Charles F. Burgess, *Journal of the Association of Engineering Societies*, 1911, p. 397.
- (ee) "Fireproof Construction and Prevention of Corrosion," William Sooy Smith, *Journal of the Association of Engineering Societies*, 1898. p. 930.
- (ff) See Cosgrove's "Principles and Practice of Plumbing," second revised edition, for Chap. XVI on "Solvent Power of Waters on Pipes and Tank Linings."
- (gg) In Cosgrove Appendix, see Chap. XXXIII, "Life of Cast Iron Pipes in Earth" and "Life of Wrought Iron Pipes in Earth."

11B3 Protective Coatings (See, also, 12C)

See the Reports of Committee D1, A.S.T.M., on "Protective Coatings for Structural Materials," referred to in January Issue (1F8) and subdivision "Protective Coatings" (1F8b); also, "Manufacture of Oils and Pigments" (1F8c), and addenda 1F8f.

- (a) "Rustless Coatings; Corrosion and Electrolysis of Iron and Steel," M. P. Wood. 432 pp., illus.
- (b) "Iron Corrosion, Anti-fouling and Anti-corrosive Paints," L. E. Andes. 283 pp., 62 illus. Translated from the German.
- (c) "Protective Coatings for Structural Materials," R. S. Perry, *Journal of the Association of Engineering Societies*, 1909, p. 399.

- (d) Many of the publications referred to under Roof Coverings, etc. (11D2), will be found to treat of methods of protection and painting. The subject will also be treated under Serial No. 12.
- (e) For other information on this subject, see Industrial Section, p. 192, "Solvay Protective Paints." The Solvay Process Company, Semet-Solvay Company; R.I.W. "Tockolith" and other products, Toch Brothers, p. 193; Patton's "Ironhide," Patton Paint Co., p. 194.

11B4 Electrolysis

See, also, "Electrolysis" (6N).

- (a) "Electrolysis in Underground Pipes," *Canadian Engineer*, Oct. 12, 1916. Abstract from Report, U. S. Bureau of Standards.
- (b) "Insulation as a Means of Minimizing Electrolysis in Underground Pipes," E. B. Rosa and Burton McCollum, "Proceedings," American Gas Institute, Vol. VI, 1911, Part 1, p. 233.

11B5 Metal Products in General (See, also, 9D5)

Next to questions concerning the corrosion and preservation of metals and the determination of the most appropriate kinds for especial uses and the proper treatment and care of each, comes the matter of the **thickness and weight of metal** to be used for any particular product.

- (a) The Editor wishes to express the opinion that a most desirable thing for architects and others specifying the use of metals to have constant access to would be a **chart** illustrating graphically and minutely the gauges for metals, the numbers for wires and other forms and factors in the fabrication of metal products. Such a presentation, accompanied by descriptive data, would afford opportunity to visualize the material to be incorporated and provide equitable conditions in estimating and a ready means of ascertaining compliance with specification requirements that could work to the advantage of all those interested in adequate and proper installations. The words "gauge" or "gauge" apparently also need standardization.
- (b) An interesting illustration of the possibilities of such a chart will be found in the Manual of the American Railway Engineering Association (1A9c) where, on page 305, appear cuts in section and elevation (shaded) showing the exact sizes of No. 1 to No. 20 gauge steel wire by American Steel and Wire Company gauge with tables of weights and comparative sizes of all wire gauges.
- (c) The U. S. Standard Gauge for Sheet and Plate Iron and Steel, 1893:
Kent's "Mechanical Engineers' Pocket Book," 1916, states: "There is in this country no uniform or standard gauge, and the same numbers in different gauges represent different thicknesses of sheets or plates. This has given rise to much misunderstanding and friction between employers and workmen and mistakes and fraud between dealers and consumers."
"An Act of Congress in 1893 established the **Standard Gauge for sheet iron and steel** (which is given). It is based on the fact that a cubic foot of iron weighs 480 pounds."
"A sheet of iron 1 foot square and 1 inch thick, weighs 40 pounds, or 640 ounces, and 1 ounce in weight should be 1/640 inch thick. The scale has been arranged so that each descriptive number represents a certain number of ounces in weight and an equal number of 640ths of an inch in thickness."
"The law enacts that on and after July 1, 1893, the new gauge shall be used in determining duties and taxes levied on sheet and plate iron and steel; and that in its application a variation of 2½ per cent either way may be allowed."

"**The Decimal Gauge:**—The legalization of the standard sheet metal gauge of 1893 and its adoption by some manufacturers of sheet iron have only added to the existing confusion of gauges. A joint Committee of the American Society of Mechanical Engineers and the American Railway Master Mechanics' Association in 1895, agreed to recommend the use of the decimal gauge, that is, a gauge whose number for each thickness is the number of thousandths of an inch in that thickness, and also to recommend 'the abandonment and disuse of the various other gauges now in use, as tending to confusion and error.' A notched gauge of oval form (shown in cut), has come into use as a standard form of the decimal gauge."

"In 1904 the Westinghouse Electric and Mfg. Co. abandoned the use of gauge numbers in referring to wire, sheet metal, etc."

- (d) Kidder's "Architects and Builders' Pocket Book," 1916, states: "**The Brown and Sharpe gauge** (B. & S.) is commonly used for designating size of copper wires (see p. 1424), also for sheet copper and brass. The American Steel and Wire Company uses the old Washburn & Moen gauge for all their steel and iron wire and also for wire nails. The sectional areas for this gauge are given on page 1426. When placing orders for sheets and wire, it is always best to specify the weight per square or linear foot or the thickness or diameter in thousandths of an inch. The gauge for steel wire, used by the J. A. Roebling's Sons Co., is given on page 403, and the circular-mil gauge on page 1387."
- (e) The U. S. Bureau of Standards has issued:
"Standard Gauge for Sheet and Plate Iron and Steel," 1911, Circular No. 18, 4 pp. 5 cents.

- (f) See "Standard Gauges" of Sheet Metal and Wire, "Lefax Data Sheet" 6-120.
- (g) For recommendations of the Associated Metal Lath Manufacturers as to gauge and weight of metal lath, see Lathing and Plastering (11D6).
- (h) See, also, 11B12 as to **standardization of metal gauges**, and 11D2j for weights of roofing tin.
- (j) The subjects of gauges, weights, and sizes of metal sheets and other data pertaining to all kinds of metals and various processes of manufacture and use will be found in the following Handbooks and Pocket Books which are here listed separately from others which have been placed under "Metal and Plastic Products" by reason of containing information about equally in detail as to each.

1. Mechanical Engineers' Pocket Book, Wm. Kent. 1916.
2. Mechanical Engineers' Handbook, Lionel S. Marks. 1916.

The above are independent of the Proceedings and other publications of the various societies, associations, and other allied interests. Lists of such publications and of many periodicals and textbooks will be found in:

3. Kent's Pocket Book, facing p. 1.
 4. Mark's Handbook, p. 21.
 5. Kidder's Pocket Book, pp. 1703-1712.
- (k) See "Transactions" of the American Institute of Metals (11A7) for proceedings, papers, discussions, and all Bulletins, which contain many valuable abstracts of metallurgical literature. The American Institute of Metals was instrumental in forming an Advisory Committee to confer with the Bureau of Standards. This Committee consists of representatives of several technical societies and meets at Washington semi-annually to suggest to the Bureau practical problems in the solution of which it might be interested and equipped to aid. The results of these conferences are recorded in the "Transactions."
- (l) "Old and New Methods of Galvanizing," Alfred Sang, "Proceedings" of Engineers' Society of Western Pennsylvania; November, 1907, 36 pp.
- (m) "Industrial Applications of Zinc," Ernest A. Smith, *Mechanical Engineer*, Oct. 6, 1916. Abstract of paper read before the Institute of Metals.
- (n) The U. S. Bureau of Standards has had a considerable amount of testing to do, mainly for the Government Departments, of plated or coated metals, especially galvanized iron. A systematic study of the manufacturing limitations and properties of this class of material was considered desirable and has been begun, and, together with a committee of the American Society for Testing Materials, the experimental data and experience are being accumulated for forming specifications for galvanized materials, including sheets, wire, and pipe.—From Report of Bureau of Standards, 1916.
- (o) The **commercial galvanized sheet product** in today's market has a base of **steel and not iron**, and specifications should either call for galvanized steel, if the regular commercial product is desired, or else should be **explicit** with respect to the iron or whatever other metal, or metal base, is to be used, for the words "galvanized iron" by themselves have, through common usage and general acceptance, come to apply to the existing steel product.
- (p) As to the **painting of galvanized metal**, the Secretary of the National Association of Sheet Metal Contractors (11A10) says in a letter "Galvanized cornice and other work should not be painted until the surface has been somewhat roughened by exposure to the weather. Two very thin coats of red lead and linseed oil will prevent the paint subsequently applied from peeling off. (See, also, 12C1 and 12E9.)"

11B6 Pipes, Conduits, Wires and Drawn Products

Attention is directed to the last two paragraphs of the General Suggestions of the National Electrical Code (6C1), urging architects to make provision for the channeling or pocketing of buildings.

The final tests and inspection of all enclosable pipes, conduits, and other metal products before they are lathed and plastered should not be overlooked.

- (a) As of much interest in connection with this Section, see "Corrosion and Treatment of Metals" (11B2).
- (b) For **Automatic Sprinkler Pipes**, see, "Fittings, Contents, and Protection Equipment" (4F); also "**Sprinklers and Fire Protection**" (9K).
- (c) For **Gas Piping**, see "Piping Buildings—Materials, Methods, and Cost" (7E).
- (d) For **Plumbing Pipes**, see "Water Supply, Storage, Utilization and Incoming Pipes" (9D); "Plumbing Installations in General" (9G); "Outgoing Pipes, Sewage Disposal, and Public Health" (9L).
- (e) For **Pipes in Connection with Heating**, see "Boilers and Heating in General," (10C); "Pipes, Valves, and Fittings" (10J).

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(f) For **Electric Conduits**, see N. E. Code, 6C2 and 6E1cc, and for "Standard Symbols and Charts," 6E4b.

(g) The Editor of the S. S. D. in an address before the N. A. of M. S. and H. W. Fitters (10A4) said:

"Why not coöperate to get rid of words in specifications which say, but do not mean, 'very best quality,' and the 'or equal,' in favor of calling for the brands, thickness and weight of pipes and for the various other products by the several names which will be acceptable?"

"More and more frequently a distinction is being made as to quality in materials of building construction, and stronger encouragement is being given to those producers who, in spite of rigid competition, adhere to their standards of manufacture and make names for themselves under established brands. By conducting an educational campaign along these lines you will oblige architects to use names and brands and standards of quality in their specification requirements which will assist them and reputable contractors, manufacturers, and producers in furnishing owners with the best that the market affords—when that is what they are paying for."

(h) "**Steel In Wrought-Iron Pipe:** A New and Quick Etching Test for Its Detection," *Iron Age*, May 11, 1916. Illus.

(j) "Manufacture and Characteristics of Wrought Iron Pipe," W. A. Phillips, *Gas Age*, May 1, 1916.

(k) For data on **Lightning Rods**, see "Lightning Protection" (4G).

(l) **Fences.** See the Manual of the American Railway Association (1A9c). The Section on "Signs, Fences, and Crossings" has a complete glossary of terms relating to fences, gates, etc., and contains Specifications for Standard Right-of-Way Fences, including materials and erection, with recommendations as to galvanizing. Contains, also, illustrations and tables of gages for plain wire, barbed-wire, and barbless fencing, and a specification for concrete fence-posts.

(m) **Nails.** In this Manual will also be found illustrations of the actual size of standard "wire nails" with tables.

(n) For "Nail Knowledge," and "More Nail Knowledge," see 5G4c.

(o) For leaflet entitled "Nails," see 5K7d.

(p) For other information on these subjects, see Industrial Section:

1. **Wrought Iron Pipe**, A. M. Byers Company, p. 225.
2. **Sherardized rigid steel conduit**, p. 173, National Metal Molding Co.
3. **Cast-Iron Pipe for House-Drainage**, p. 223; and **Drainage Fittings**, p. 218.

11B7 Windows, Doors and Metal Trim

(a) The following should be consulted before equipping building walls or partitions with windows or doors:

1. "Regulations of the N.B.F.U. for the **Protection of Openings in Walls and Partitions against Fire**. Recommended by the N.F.P.A. Edition of 1915" (4C3b).

2. Underwriters' Laboratories' "Specifications for Construction of Tin-Clad Fire-Doors and Shutters" and:

3. "Hollow Metallic Window Frames and Sashes for Wired Glass" (4C3b).

4. Also, "Specifications: **Tin-Clad Fire-Doors and Shutters**, 1914" (4C3c), Inspection Department, A.F.M.F.I. Co's. This specification is likewise applicable to the installation of sheet-metal doors.

5. Also "Beltway Fires" (3A744).

6. For **Fire-Doors and Shutters, Frames for Fire-Doors and Shutters, Frames and Sashes for Wired Glass, Fire Window-Frames**, see "List of Inspected Mechanical Appliances" of the Underwriters' Laboratories (3A6b).

7. For same, see, also, "Approved Fire Protection Appliances" of the A.F.M.F.I. Co's (3A743).

8. For Hardware for the above, see 11B11h.

(b) For "Standards for Counterbalanced Elevator Doors," see Underwriters' Laboratories (3A6h).

(c) The Committee on Construction of the National Association of Manufacturers of **Approved Hollow Metal Window-Frames and Sash** has been working with a committee appointed by the Laboratories, and this joint committee has decided to test various constructions, some of which have passed through tests, apparently with great success, others are still to be put through. One thing which has already been definitely and officially accomplished is the abolition of a mullion which the Laboratories demanded should be placed between two units, if the opening was larger than 5 x 9 feet. The old style mullion was made of a 5-inch I-beam, surrounded by concrete and enclosed in sheet metal.

The new mullion now made, if non-bearing, is composed of two channel irons made of No. 16 gauge, which are tied together with a strip of No. 24 gauge galvanized iron. This permits the two windows to be set back to back and not only eliminates the expense of the old-style mullion, but also permits the distance from glass-line to glass-line, in this new mullion window, to be 5 inches narrower than the old style. As in modern construction the glass area in a window-opening is of the utmost

consequence, this advantage is very great.—(Extract from a letter from President Fred De Coningh.)

(d) "**Fire-retardent Windows**," S. H. Pomeroy. Address delivered before New York Chapter of N.F.P.A. Printed in *Construction* for June and July, 1917.

(e) "**The Casement Sash**," James C. Plant, *Journal of the Society of Constructors of Federal Buildings*, September, 1916. Illus.

(f) "**Fire-tests of Doors and Windows at Underwriters' Laboratories**," M. L. Carr, *Construction*, July, 1917. Illus.

(g) For reference to experiments to determine the relative heat lost through single- and double-glazed wood, steel and hollow metal sash, and many other matters of interest, see "**Air Leakage, Guarantees and Formulae**" October Issue, 10M.

(h) For **Metal Weather-strips**, see 10M14 and 15.

(j) For "**Almeti**" **Fire-doors and Shutters**, see Industrial Section, p. 224, Merchant & Evans Co.

11B8 Mail Chutes

(a) The U. S. Post Office Department issues "Section 720, Postal Laws and Regulations" under an "Order No. 148 of the Postmaster General," dated Aug. 8, 1905, which describes the kinds of buildings in which mail chutes may be installed, the location therein of same, and the essential characteristics of construction.

(b) Copies of these regulations may be also obtained from the Cutler Mail Chute Co., which, in a recent circular letter, calls attention to a letter from the Post Office Department, stating that it will not in future waive the rule requiring the Mail Chute Box to be placed within fifty (50) feet of the main entrance of a building.

(c) See Industrial Section, p. 210, Cutler Mail Chute Company.

11B9 Laundry Chutes

(a) For reference to Glass Enameled Steel Laundry Chutes, see 9H1 and Industrial Section, p. 213, Pfadler Co.

11B10 Appliances, Fixtures, Fittings and Devices

(a) For **Electrical Appliances**, see "Apparatus, Appliances and Installations in General" (6E); "**Electric Elevators and Dumb Waiters**" (6F); "**Heating, Cooking and Other Appliances and Devices**" (6J).

For **Electric Switches and Wiring Devices**, see Industrial Section, pp. 148-158, General Electric Co.

(b) For **Gas Appliances**, see "Gas Appliances in General" (7H); "**Space-Heating by Gas**" (7J); "**Water-Heating by Gas**" (7K); "**Cooking and Hotel and Domestic Appliances**" (7L).

See Industrial Section, p. 212, for Automatic Gas Water Heater, Humphrey Co.

(c) For **Radiators, Registers, and Grills**, see 10K; also Industrial Section, p. 176, for Ventilating Gas Radiator, Hugo Mfg. Co.

(d) For **Stoves, Ranges and Dryers**, see "Warm-Air Heating, Stoves, Ranges and Dryers" (10D).

(e) For **Plumbing Fixtures and Fittings**, see "Fixtures and Fittings" (9H), and "Bathroom and Laundry Finishes and Accessories" (9H1).

See Industrial Section for **Plumbing Fixtures and Fittings**, as follows: (1) Crane Co., p. 218; (2) Kohler Co., pp. 214-215; (3) Trenton Potteries Co., p. 217; (4) Loomis-Manning Filter Distributing Co., p. 216.

(f) For **Valves and Fittings**, see "Pipes, Valves, and Fittings" (10J).

(g) **Post-Caps, Hangers, Struts** and similar structural devices are important metal products, references to which will be found in many of the publications listed in the Wood issue, Serial No. 5, May, and are specifically referred to also under 5G4.

1. These, together with anchors, bolts, angles, clamps, and other fasteners and supports for terra-cotta work, cornices, etc., and for interior false work, will be found described and illustrated in many of the references given in March and April issues especially, 4D4.

2. For **Wall-Hangers, Post-Cap and Girder Supports**, see "List of Inspected Mechanical Appliances," Underwriters' Laboratories (3A6b).

3. For same, see, also, "Approved Fire Protection Appliances," A.F.M.F.I. Co's (3A743).

(h) "**Anchors for Lateral Stability for the Architectural Detailer and Stone Setter**," Ernest G. Schurig, *Journal of the Society of Constructors of Federal Buildings*, May, 1916. Illus.

(j) "**Wall-Fastening Devices**," C. McFarland, followed by discussions, *Journal of the Society of Constructors of Federal Buildings*, March, 1916.

(k) "**Safety Devices for Elevators**," Jacob Gentz, Jr., *Power*, Jan. 9, 1917. Illus.

(l) See "The Arrangement and Requirements of Elevators in Office Buildings," Cecil F. Baker (from the *Architectural Record*), "*Engineering-Contracting*," May 17, 1916.

- (m) For Electric Elevators, see Industrial Section: (1) Otis Elevator Co., pp. 170, 171; (2) A. B. See Electric Elevator Co., pp. 160, 161.
- (n) For Hand Power Elevators and Dumb Waiters, see Industrial Section, pp. 220, 221, Sedgwick Machine Works.
- (o) For Hydraulic Elevators, see 10O10 and for Vacuum Cleaners, see 6K and 10O1m.

11B11 Hardware

- (a) "The American Hardware Manufacturer" is the official organ of the American Hardware Manufacturers' Association (11A13). This Association, which recently accepted membership on the National Industrial Conference Board, has, through its officers and Executive Committee, inaugurated a significant movement in which architects and the prospective owners of buildings throughout the country may greatly aid.

Started in May of this year, specifically for the purpose of conserving men and money in time of war, but destined, with that approbation which will surely be forthcoming, to make for permanency and lead to standardization of purpose and procedure, the members have concurred in a Resolution to reduce the number of styles of hardware, to curtail the different kinds of finishes, and to eliminate all slow-selling items.

This action has been commended by the Commercial Economy Board of the Council of National Defense which has said, "in practically every trade there have grown up non-essential services, some of them mere conveniences, and others hardly that; in time of peace they may be permissible; in time of war they are a serious waste and should be stopped . . . concerns should curtail excess variety of styles."

Architects, in specifying and selecting hardware, are urged to take an important part in this desirable economic reform. The saving in the publication and examination of manufacturers' catalogues alone would be very considerable in money and in time, to say nothing of the vastly greater reduction in cost of manufacture and handling, in the wake of which other improvements would result.

The Structural Service Department may be counted upon to do its part in this direction and in others, such as establishing definitions of "right and left-hand" doors, and steps are already being taken.

- (b) The National Retail Hardware Association (11A14) is devoting attention to research, the analytical study of modern hardware problems, and the devising and recommendation of methods and standards for the application of greater economies to hardware distribution and more efficient merchandising. The official organ of the Association is the *National Hardware Bulletin*, published monthly.
- (c) "Details to Which Standard Hardware Can Be Applied" is a series of 27 plates, 8½ x 11, bound in cloth, drawn by F. M. Snyder, Architect, for twelve hardware manufacturers, by whom it has been distributed. It bears on the title page "As Chairman of the Committee on Materials and Methods of the A.I.A. I am glad to have this opportunity of expressing approval of this much-desired publication.—THOMAS NOLAN."
- (d) The Navy Department issues specifications for various kinds of hardware, including:
 - Double-Acting Spring Butt Hinges (42H20a), illus.; Liquid Door Checks (42C8a); Sash Cord (42C9a); and others, for index to which see 3A1a1.
- (e) See "Finishing Hardware," Fred G. Hammer, followed by discussion, *Journal of the Society of Constructors of Federal Buildings*, March, 1916.
- (f) "Troubles with Hardware," Charles E. Morrell, Jr., *Journal of the Society of Constructors of Federal Buildings*, September, 1915.
- (g) See, *Locks and Builders' Hardware*, Henry M. Towne. 1117 pp.
- (h) For Hardware for Fire-Doors and Shutters, Automatic Closers, Door-Checks, Panic-Bar Latch Release, Hardware for Fire Window-Frames, Fusible Links, Transom and Transom Operators, and other devices, see "List of Inspected Mechanical Appliances," Underwriters' Laboratories.
- (j) For same, see, also, "Approved Fire-protection Appliances" of the A.F.M.F.I. Co's (3A7a3).
- (k) For reference to Self-releasing Fire-exit Latches, see 5G4g, and, also, Industrial Section, p. 147, Vonnegut Hardware Co.
- (l) For reference to Pulleys and standardization data, see 5G4d.
- (m) "Method of Fastening Sash Tape," Harry G. Richey, *Journal of Society of Constructors of Federal Buildings*, September, 1915.
- (n) The Bureau is frequently called upon to test the wearing quality of window-sash cord. To carry out this work, there has been in use for several years a special testing machine which was designed by the Bureau to duplicate as far as possible the actual conditions of service. The results obtained in testing a variety of sash-cord prove that the wearing quality of the cord is, within wide limits, quite independent of its tensile strength,

but is dependent in a remarkable fashion upon oils, greases, and other substances which are naturally present or are added by design.—(From Report of the Bureau of Standards, 1916.)

11B12 "Ornamental" Metal Work

- (a) The Standardization Committee of the Architectural Iron and Bronze Manufacturers (11A8), Mr. Hugh White, Chairman, has for several months been working on standard specifications, but on account of abnormal conditions the project has been indefinitely postponed.
- (b) The National Association of Ornamental Iron and Bronze Manufacturers (11A9) is working with the Government to standardize metal gauges of all kinds.
- (c) The Standardization Committee of the National Association of Brass Manufacturers (11A11) will report, in December.
- (d) "Architectural Bronze," Clarence A. Fullerton, followed by discussion, *Journal of the Society of Constructors of Federal Buildings*, March, 1916. Illus.
- (e) "Architectural Wrought Iron, Ancient and Modern," W. W. Kent. A compilation from various sources of German, Swiss, Italian, French, English, and American ironwork, from medieval times to the present day. Illus.
- (f) "A Handbook of Art Smithing," F. S. Meyer. For the use of practical smiths, designers of ironwork, technical and art schools, and architects. Illus.
- (g) "Plain and Ornamental Forging," Ernst Schwarzkopf. 1916.
- (h) "Making Thin Wall Ornamental Brass Castings," R. S. B. Wallace, *Mechanical Engineer*, Jan. 12, 1917. Paper read before American Institute of Metals.
- (j) Members of the art commissions of the cities of New York, Philadelphia, and Detroit, as well as certain art-bronze manufacturers, have urged the Bureau to take up the question of the standardization of art bronzes for outdoor statuary. This should include a determination of the most suitable chemical composition, the production of a desirable and agreeable patina, and methods of care and cleaning such statues. In the different cities of the country, statues oftentimes take on an unsightly appearance, largely caused by the contaminated atmosphere. It is believed a systematic study will go far toward improving this condition.—(From Report, Bureau of Standards, 1916.)
- (k) For "The Equestrian Statues of the World," see 32-page booklet by The American Scenic and Historic Preservation Society (12L).
- (l) See Industrial Section, p. 209 for illustration and details of Bronze Store-Front Construction, The Gorham Co., Architectural Bronze.
- (m) See Industrial Section, p. 219, for illustrations and details of Steel Wainscot and Bookcases, Dahlstrom Metallic Door Co.

11B13 Lighting Fixtures

- (a) Specifications for same will be found in "Mechanical Equipment of Federal Buildings" (6L1g).
- (b) For electric lighting fixtures, see "Illumination, Lighting Fixtures and Lamps" (6H).
- (c) For gas lighting fixtures, see "Illumination—Fixtures, Equipment and Ignition" (7M, especially 7M17).
- (d) See, also, Report of Committee of the American Gas Institute on Piping Large Buildings for Gas (7A2k), which contains an extended section on "Fixture Illustrations" pp. 39-53.
- (e) See Electrical Specifications, U. S. Army (6O). Illustrated.

11B14 Stairways, Fire-Escapes, Slipping Hazards

- (a) For information on "Exits—Stairways and Fire-Escapes, Safety to Life, Slipping Hazards," see Sections 4E to 4E3.
- (b) For Fire-Escapes and Safety Treads, see "List of Inspected Mechanical Appliances," Underwriters' Laboratories (3A6b), and "List of Appliances Inspected for Accident Hazard."
- (c) "Selecting Abrasives for Specific Uses," R. G. Williams, *Industrial Management*, January, 1917. Illus.
- (d) "Some Hazards and Safety Suggestions," H. W. Mowery. Illustrated address presented under the auspices of The American Museum of Safety, December, 1915.
- (e) "Slipping and Tripping," H. W. Mowery. Presented to the Philadelphia Local National Safety Council, at Franklin Institute, March, 1917.
- (f) For detailed data on "Feralun" Anti-Slip Treads, see, p. 168, American Abrasive Metals Co.

[NOTE.—Though this issue treats of Metal Products in General, the subject of Store-Front Construction will be covered in Serial No. 12, on account of its relation to Plate Glass, see 12F4.

11C Plastic Materials and Products

See, also, Metal and Plastic Products (11D1g) for handbooks and other publications which treat of both together, and see various subdivisions of that heading wherein plastic products are mentioned in connection with metal products.

11C1 Cement, Lime and Gypsum, in General

- (a) See Proceedings, A.S.T.M. (1A4a), for the following reports of committees:
Cement (A.S.T.M.: C-1); **Lime** (A.S.T.M.: C-7); **Concrete and Concrete Aggregates** (A.S.T.M.: C-9); **Gypsum and Gypsum Products** (A.S.T.M.: C-11).
- (b) "**Cements, Limes, and Plasters: Their Materials, Manufacture, and Properties**," Edwin C. Eckel, Assistant Geologist U. S. Geological Survey. 712 pp., illus.
- (c) "**Concretes, Cements, Mortars, Plasters, and Stuccos**," F. T. Hodgson, Architect. 500 pp., illus.
- (d) For detailed information and references **Lime and Hydrated Lime** for various purposes (chiefly mortars), see 2B to 2B10.
- (e) The plasticity and sand-carrying capacity of lime are properties of great importance commercially, yet their measurement has always been an extremely difficult matter. A method for making this measurement has finally been developed, and an instrument has been built for the purpose. A lime paste or mortar is molded into form and immediately subjected to compression. The load required to produce rupture and the amount of deformation before rupture are found to depend upon the plasticity of the material.—(Report, Bureau of Standards, 1916.)
- (f) For **Gypsum used in Building Construction**, see references listed under 4B1bb.
- (g) See reference to Annual Statement of U. S. Geological Survey pertaining to **Gypsum**, listed under 4K3.
- (h) In the matter of evolving standard specifications for **Gypsum** and methods for testing the material, see 4K5.
- (j) "**Gypsum Deposits in the U. S.**," G. I. Adams and others. Bulletin No. 223 of the U. S. Geological Survey. 1904. 129 pp.
- (k) See, 1E1 to 1E8 for references to **Cement and Concrete** of structural significance, the following being given chiefly in connection with the consideration of surfacing these materials. The finishing of cement and other surfaces, as in "stucco," will be more fully treated under Lathing and Plastering, 11D6.
- (l) "**The Decorative Possibilities of Concrete**," C. W. Boynton and J. H. Libberton, *Journal of the Association of Engineering Societies*, 1913, p. 719.
- (m) "**Concrete Construction for Rural Communities**," Roy A. Seaton. 225 pp.; illus.
- (n) See sections in "Inspector's Handbook of Reinforced Concrete," W. F. Ballinger and E. G. Perot, Architects. 64 pp.
- (o) "**The Cement Gun**," *Engineering* (London), June 9, 1916. Illus.
- (p) "**The Cement Gun and Its Work**," Carl Weber, *Journal of the Association of Engineering Societies*, 1914, p. 272.
- (q) "**Coating Steel at Grand Central Terminal with Cement Gun**," W. F. Jordan, *Engineering News Record*, May 25, 1916.
- (r) "**Sand Lime-Brick in 1915**," Jefferson Middleton. Reprint from "Mineral Resources of the U. S.," Part II, U. S. Geological Survey, 1916.
- (s) "**Manufacture and Properties of Sand-Lime Brick**," Warren E. Emley, March, 1917. Technologic Paper No. 85, Bureau of Standards. 10 cents.
- (t) "**Properties of some European Plastic Fire Clays**," A. V. Bleininger and H. G. Schurecht. 1916. Technologic Paper No. 79, U. S. Bureau of Standards. 34 pp., illus. 10 cents.
- (u) **Concerning Cement**, see, also, Industrial Section: (1) The Atlas Portland Cement Co., pp. 198, 199; and **concerning Gypsum**, see p. 205, United States Gypsum Company.

11C2 Bituminous Materials—Damp-proofing and Waterproofing

For other information on "Waterproofing and Damp-proofing," see 1D to 1D6, inclusive.

- (a) See Reports of Committee D-8, A.S.T.M., on **Waterproofing**.
It is of interest to note that the A.S.T.M. at its Convention in June recommended that hereafter the word "damp-proofing" shall be added to the word "waterproofing" and combined as "damp-proofing and waterproofing" in committee reports.
In accordance with the programme outlined last year, the Committee submitted—four "proposed tentative specifications" (see Titles in A.S.T.M. Book) for Asphalt, for Primer, for Coal-Tar Pitch, and for Creosote Oil, all when used for damp-proofing and waterproofing under uniformly moderate temperatures.
Because of present conditions, arising from the state of war in which our country is involved, no conclusive work in the matter of conveying media—saturated felts and woven fabrics—

has been accomplished, and before specifications covering these materials can be drawn up, the questionable part which they actually play in a finished waterproofing membrane must be definitely settled. The present unnatural state of the rag market is another controlling economic feature which at present militates against the preparation of specifications covering media.

- (b) See, also, "**Heat Transmission, Insulation, Coverings**" (10N), which contains many publications of interest.
- (c) "**The Asphalt Industry**" (from an interview with James L. Rake), "Proceedings," Engineers' Club of Philadelphia, January, 1917. Illus.
- (d) "**Asphalts: Their Sources and Utilization**," T. Hugh Boorman. Contains addenda treating on general waterproof construction.
- (e) "**Effects of Exposure on Tar Products**," C. S. Reeve and B. A. Anderton, *Journal*, Franklin Institute, October. Illus.
- (f) "**Waterproofing**," Thomas Appleton, *Journal of Society of Constructors of Federal Buildings*, May, 1915.
- (g) See the following in the *Journal of the Society of Constructors of Federal Buildings*, issue of February, 1917:
 1. "**Waterproofing**," a paper by A. Grothwell.
 2. "**Integral Waterproofing**," a paper by Mr. Horn.
 3. "**Technical Paints**," a paper by A. H. Rhett.
- (h) "**Prevention of Dampness in Buildings**," A. W. Keim. Translated from the second revised German edition. 115 pp.
- (j) "**Modern Methods of Waterproofing**," Myron H. Lewis. Covers principles, methods and precautions. 44 pp., illus.
- (k) "**Waterproofing of Engineering Structures**," W. H. Finley, *Journal of the Association of Engineering Societies*, 1912, p. 545.
- (l) See "Smoke and Water Damage," F. E. Roberts, N.F.P.A. *Quarterly*, Vol. 7, No. 4 (4D1l).
- (m) For references to information in Industrial Section, see 1D2h.

11C3 Cast Stone

- (a) In addition to its inclusion within some of the publications referred to elsewhere, this subject will be found treated in the literature of the manufacturers.
- (b) "**Concrete Stone Manufacture**," H. Whipple. 1915. 77 pp., illus.
- (c) Some Physical Properties of Magnesian Cement Mortars and Concrete, Univ. of Calif. Bulletin, March 4, 1915.
- (d) See **Recommended Practice** of American Concrete Institute (1E6m).
- (e) See **Standard Specifications** of A.C.I. referred to under 1E7g.
- (f) See **Standard Building Regulations** of A.C.I. under 1E7h.

11C4 Floor, Wall and Ceiling Tile (See, also, 9H1)

- (a) The purpose of the Associated Tile Manufacturers (11A17) and its offers of practical service to architects are mentioned in the Industrial Section on p. 211. Among the publications of the Association are:
 1. "**Specifications for Setting Tile**." The Association is working on the revision of these specifications.
 2. "**Tile Floors and Walls for Hospitals**."
 3. "**Swimming-Pools**." (See 9J29.)
 4. "**Plates**," showing different classes of work in buildings, which are mailed to architects at frequent intervals.
- (b) For "A Bibliography of Clays and the Ceramic Arts" and other publications of the American Ceramic Society, Inc., see 3C1.
- (c) The U. S. Navy Department issues specifications (3A1a2) for "Tiles" serial designation 59T2, August 1, 1916.
- (d) "**The Craft of Tile-Making and Its Relation to Architecture**," J. H. Dulles Allen, in the *Journal* of the A.I.A., January, 1915.
- (e) "**Pottery**," A. Beckwith. Observations on materials and manufacture of terra cotta, stoneware, firebrick, porcelain, earthenware, brick, majolica, and encaustic tiles. 101 pp.
- (f) "**A Treatise on Ceramic Industries**," Emile Bourry. A manual for pottery, tile, and brick manufactures. 488 pp., illus.
- (g) See, also, "**Building Stones and Clay Products**," Heinrich Ries. A handbook for architects. 415 pp., illus.
- (h) "**Tests of Adhesion of Face Tile to Concrete Backing**," *Engineering News Record*, June 22, 1916. Illus.

11C5 Roofing Tile (See, also, Roof Coverings, 11D2)

- (a) See some of the publications listed under Terra-Cotta, Hollow Tile and Brick (3D1); also literature of University of Illinois (3C2); also some of those in preceding Tile Section.
- (b) In its report at recent annual meeting, the Committee on Allied Arts of the Philadelphia Chapter of the A.I.A. made the recommendation that the Institute's Committees on Allied Arts and Materials and Methods exert an influence with the large factories to turn out a more interesting product.
- (c) For reference to this product, see Industrial Section, p. 208, O. W. Ketcham.

11D Metal and Plastic Products

See Metals and Metal Products (11B); also Plastic Materials and Products (11C) for references to each of these separately. The intention is under this combined heading to refer to those publications which treat of both products equally in detail and to those branches of construction where both metal and plastic products are under consideration at the same time.

Attention is directed to the offers made placing the facilities of their departments for investigation, research, and cooperative work at the disposal of architects and other citizens by the Bureau of Standards (1A2) and the Geological Survey (2A1).

The Government has published a very interesting report upon "Substitution of Other Materials for Wood," which forms a part of the investigation of the Federal Trade Commission and of the Forest Service into conditions within the lumber industry, and is now for the first time made available to the general public.

The report is illustrated with charts, showing the relative trend in prices of lumber, brick, cements, structural iron and general prices for twenty-five years, ending 1915; also other charts showing (in part) the consumption of building brick, of iron and steel structural shapes, natural and Portland cement, of clay building materials, and of cut and wire nails. There is also a graphic study of building permits in twenty of the larger cities of the country. The increasing use of metal trim and metal furniture is graphically shown by another diagram. Copies of the report may be obtained for 15 cents from the Superintendent of Documents, Washington, D. C.—(From November News Letter, 1917, N.F.P.A.)

11D1 Materials in General

- (a) See "Mineral Resources of the U. S." Part I, "Metals;" Part II, "Non-Metals," separate Chapters of which are devoted to various metals and plastic products (2A1b and c), U. S. Geological Survey.
- (b) "The Testing of Materials," Circular No. 45 of the Bureau of Standards. 1913. 10 cents. Treats of the tests of Metals and Metal Products, Composite Metal Products, Cements (hydraulic and Concrete, Burnt Lime, Hydrated Lime, and Sand-Lime-Brick.
- (c) For account of the fire-tests on columns and coverings—which include various metal and plastic products—being conducted at the Underwriters' Laboratories in Chicago, and at the Bureau of Standards in Pittsburgh and at Washington, see 3E3.
- (d) See, also, "Reports on Buildings under Fire" (3E1), and "Reports on Fire Tests of Materials" (3E2).
- (e) The Navy Department issues specifications for many metal and plastic products, such as:
Expanded Metal—47M1; Safes—54S1a; Metal Furniture for Use of Vessels of the U. S. Navy—26F1b; Cotton Canvas—24C8b; Asbestos Plaster-Plastic Laggging Material—32P2a; Tarred Sheathing Felt—33F1a; Trinidad Asphalt—59A1; Asbestos Plaster Cement—32P1; and others, for index to which see 3A1a1.
- (f) A large number of manufactured products of various kinds referred to herein may be seen at Architects' Samples Corporation display rooms, Architects Bldg., 101 Park Avenue, N. Y. City.
- (g) See the Sections, articles, descriptions, and illustrations pertaining to practically all metal and plastic products, including those covered by various headings and subdivisions in this issue, in:
1. Kidder's Architects' and Builders' Pocket Book. 1916.
2. Trautwine's Civil Engineers' Pocket Book. 1913.
3. American Civil Engineers' Pocket Book, Merriman. 1916.
4. Building Construction and Superintendence: Part I. Masons' Work, Kidder. 1914. Revised and enlarged by Thomas Nolan.
5. The Building Estimator's Reference Book, Frank R. Walker. 1917.
6. The New Building Estimator, William Arthur.
7. Handbook of Cost Data, Halbert P. Gillete.
8. Building Code Recommended by the N.B.F.U., 1915.
9. Dwelling Houses—A Code of Suggestions for the Construction and Fire-Protection (3A4d2).
10. Field Practice—Inspection Manual of the N.F.P.A. (3A3d1).
11. The Metal Lath Handbook (3C11a).
12. "Fire Prevention and Fire Protection," J. K. Freitag.
13. "Fireproofing of Steel Buildings," J. K. Freitag. 1909.
14. Crosby-Fiske Handbook of Fire Prevention. 1914.
15. "A Handbook for Superintendents of Construction, Architects, Builders, and Building Inspectors," H. G. Richey. 742 pp., illus.
16. "Building Foreman's Pocket Book and Ready Reference," H. G. Richey. 1118 pp., illus.
17. "Materials of Construction," Adelbert P. Mills. Treats of manufacture, properties, and use. 682 pp., illus.
18. "Inspection of Materials and Workmanship Employed in Construction," Austin T. Bryne. A reference book for the use of inspectors, superintendents, and others engaged in the construction of public and private works.

19. "Materials of Construction," C. B. Johnson. A treatise on the strength of engineering materials. 795 pp., illus.
20. "Cyclopedia of Architecture, Carpentry, Building," American School of Correspondence. 10 volumes.
21. International Library of Technology, International Text-22. I.C.S. Building Trades Pocket Book. [book Company.
23. Universal Safety Standards, Carl M. Hanson. 1914.
24. "Handbook for Architects and Builders." Illinois Society of Architects, Vol. xx. 1917.
- (h) See, also, Industrial Section, p. 197, concerning Engineering Service Department, Corrugated Bar Co., and pp. 142-144 concerning Engineering, Inspection and Laboratory Services, Robert W. Hunt & Company.

11D2 Roof Coverings—also Sheet Metal Work, Cornices, Skylights and Ventilators

Before arranging for the placing of light-shafts, roof-openings, ventilators, cornices, etc., a study should be made of the latest report of the Committee on Roof Openings and Cornices in Proceedings N.F.P.A., with discussion which followed—pp. 317-333 in 1917—and of the Section on Skylights in the N.B.F.U. Building Code, 1915 (3A4d1). The "Regulations" of the N.B.F.U. as recommended by the N.F.P.A. on Skylights (3A3a20) should also be obtained and followed.

- (a) A most interesting symposium on the subject is the Section "Roofings" in the Manual of the American Railway Association (1A9c), in which are taken up considerations in selecting roofings, classification of important materials, under which is discussed the properties and relative advantages and economies of each. Felts are described and discussed, also built-up roofs, tile, brick, slate, asbestos shingles, cement tile, metallic roofings and ready roofings, with conclusions and recommendations given with respect to flashings, flat roofs, allowable slopes and other features.
- (b) Wood Shingles, see "Shingles, Lathing and Wall Boards" (5K).
- (c) For Slate Roofing, see 2K1 to 2K8, inclusive.
- (d) For Tile Roofing, see 11C5.
- (e) For various kinds of roofing, see references under "Horizontal and Sloping Features" (4D).
- (f) Skylights and Ventilators, see, also, "Natural Ventilation" (10G).
- (g) For sheet metal work, see, especially, "Metal Work, Ducts, Chase Lathing" (10L), and "Metal Products in General" 11B5.
- (h) The National Association of Sheet Metal Contractors of the U. S. (11A70) issues the following:
1. "Warm Air Heating and Sheet Metal Journal" (See 10D7.)
2. "Tin Roofer's Handbook," 1907. Contains "A Brief History of Tin Roofing;" "Advantages of a Good Tin Roof;" "Working Specifications;" "Standard Specifications;" "Practical Hints" and weight per square of different kinds of roofing. 23 pp., diagrammatically illustrated, showing the development and completion of the seams in flat and standing-seam roofing. Free upon request.
3. Circular entitled "Tin Roofing Facts for Architects' Use" states the application, cost, maintenance, advantages, and quality of tin roofing.
4. "Standard Specifications for Tin Roofing Work," 1909. These specifications were compiled for the original Association then known (organized 1905) as the National Association of Master Sheet Metal Workers by a joint committee of tin roofers, representing all sections of the country, and manufacturers of tin roofing plate. They were adopted by the Association as standard in August, 1909, and have remained unchanged since. They have been widely referred to and are printed and distributed by certain manufacturers of tin roofing and recommended for use. They are comparatively brief and so worded that they may be incorporated into architects' specifications.
Application suggested by the Editor of the S.S.D.:
"Wherever tin roofing is shown, marked, indicated or specified it shall be of (name the brand only, not the thickness which, for differing portions of the roof, is covered by the specification) laid and painted in accordance with the Standard Specification for Tin Roofing Work of the National Association of Sheet Metal Contractors of the U. S., edition of August, 1909, with any subsequent official amendments thereto. (This proviso is added merely to make the application up to date, no matter when used.)"
This specification is referred to with especial interest as indicating how a product shall be used, the literature of many manufacturers concerning itself chiefly with the why.
(j) The following notes explain the terms indicating the weight rather than the thickness governing the manufacture and use of roofing tin and are furnished by a leading manufacturer:
The terms "1C" and "1X" are universal in the Tin Plate Industry throughout the world, as denoting the gauges of the

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plates that are most generally used. Originally the "IC" was simply "C" and denoted the word "common," that is, the common thickness of plates, which was 1 pound for each sheet of 14 x 20 inches, or 2 pounds for each sheet of 20 x 28 inches. These plates were always packed 112 sheets to a box, thus giving the English hundredweight for the 14 x 20, which was the usual size, or two hundredweights for the 20 x 28 inches.

A thicker plate is, of course, better, and the next heaviest thickness to the "C" was marked with a "X" (as on bags of flour, XX and XXX to indicate quality) but in the Tin Plate business these marks indicated thicknesses.

The British used the hundredweight of 112 pounds, and their IX plate for the 112 sheets of 14 x 20 inches was a quarter of a hundredweight heavier than the "C" plate, or, in other words, was 140 pounds. They had plates which weighed 168 pounds, and these they marked "XX" and on up, which thicknesses, however, are used only for tinware, dairy utensils, etc.

It became quite usual to put a one before the cross in order to indicate that it was IX only, and as time elapsed, the original meaning of the signs became obscured, and people in the trade began to write this figure one (1), or, as it is sometimes called, a letter "I," before all the gauges, hence the expression "IC." Another leading manufacturer states that the term "IC," originated as the abbreviation of "1 cwt." and that the symbol is pronounced "eyesec."

- (k) The unusual demands for **Tin Plate** in this war year have led mills to tin a much greater proportion of their **black plate** production than is ordinarily the case. This practice, says a statement issued by the Bureau of Foreign and Domestic Commerce, will also be followed next year, judging from figures just made public by the **Tin Plate Conservation Committee** and which are based on returns from the large producers.
- (l) See "**The Manufacture of Terne Plates**," W. Sebald, *Journal of Society of Constructors of Federal Buildings*, March, 1916.
- (m) "**Metallic Roofing**," D. M. Buck. 48 pp. Paper and discussion in "Proceedings" of Engineers' Society of Western Pennsylvania for December, 1911.
- (n) "**Laying Copper Roofing and Gutters**," William Neubecker. Fifth of a series of six articles showing methods employed in providing for expansion and contraction of the metal—laying copper roofing on wood battens. Illus. In *Sheet Metal* for September, 1917.
- (o) "**Copper Roofs**," John W. Ginder, *Journal of the Society of Constructors of Federal Buildings*, November, 1914.
- (p) "**Sheet Metal Work**," William Neubecker. A practical guide to sheet metal work, cornice work, skylight work, metal roofing, pattern drafting, etc. 267 pp., illus.
- (q) "**Practical Metal Plate Work**," P. N. Hasluck. Illus.
- (r) See "**Practical Sheet Metal Work and Demonstrated Patterns**," 8½ x 11 inches. Bound. Illus. Some of the volumes are: 1. **Leaders and Leader Heads**. 113 pp. 2. **Gutters and Roof Outlets**. 116 pp. 3. **Roofing**. 138 pp. 4. **Ridging and Corrugated Iron Work**. 132 pp. 5. **Cornice Patterns**. 119 pp. 6. **Circular Cornice Work**. 126 pp. 7. **Practical Cornice Work**. 139 pp. 8. **Skylights**. 122 pp.
- (s) See "Smith's Tables for Skylights and Roofs," 84 pp., illus.
- (t) For **Roof Coverings**, other than metal, see "List of Inspected Mechanical Appliances," Underwriters' Laboratories (3A6b). The same are classified under Underwriters' Standards for Roof Coverings according to their fire-retardant qualities, as follows: **Class A**, **Class B**, **Class C**. The following is quoted: "Roof coverings should be suitable for, and in keeping with, the types and classes of buildings upon which they are installed. Roof coverings of any of the above classes can be employed in situations where the fire exposure is less severe than if used in situations where the fire exposure is more severe than that for which they are classified; the increased fire hazard should be recognized. **Inspection Departments having jurisdiction should be consulted** regarding which class roof covering will be acceptable in the locations proposed."
- (u) For "**Classification of Roofs and Roofings**," see five references in N.F.P.A. "Index" (3A3h5).
- (v) See "**Roof Covering Tests**," N.F.P.A. *Quarterly*, Vol. 4, No. 1, and Vol. 10, No. 4.
- (w) See "**Asbestos Roofing**," N.F.P.A. *Quarterly*, Vol. 6, No. 2.
- (x) For "**Standard Specifications for Asbestos Shingles**," see 4D3c3.
- (y) See "**Asbestos Roofing Shingles, Asbestos Protected Metal and Other Products**" (4D1f5), F. E. Kidder.
- (z) The publication 3A4c3 contains an "**Ordinance for Fire-Resistive Roof Coverings**."
- (aa) "**Taking care of Water from Roofs**," *Metal Worker*, Jan. 5, 1917.
- (bb) "**Discussion of Conductor Heads for Roof Drainage**," Alfred M. Wolf, *Engineering News Record*, May 11, 1916. Illus.
- (cc) For data on **proportioning gutters and conductors to the roof surface**, see Kidder, 1916, p. 1578.
- (dd) For **detailed working drawings** showing the methods of **applying tin** for roofing, cornice decks and on domes, dormers, etc.,

with flat seams, standing seams, ribs and various forms of construction, see Service Sheets No. 18-1, 2 and 3.—Copyright by N. & G. Taylor Co., published by Architectural Service Corporation, Philadelphia. On the backs of these sheets and in the Industrial Section on p. 146 will be found specification notes and other data on roofing tin.

- (ee) For other information on materials and products applicable to this Section, see pages in the Industrial Section as follows:
 1. Detailed data on Swartwout Rotary, Ball-bearing Ventilators, p. 224, The Ohio Blower Co.
 2. Specifications for Flat Slate Roofs and other data, North Bangor Slate Co., p. 204.
 3. Slate Surfaced Asphalt Shingles, Certain-teed Products Corporation, p. 172.
 4. Roofing Tin, p. 224, Merchant & Evans Co.

11D3 Floor Systems, Partitions, Furring, etc.

- (a) The principal literature, and the latest, pertaining to these products is issued by the manufacturers. Descriptions and illustrations of various types of construction with these materials will be found specifically in the following, and in some of the Handbooks and others mentioned elsewhere in this issue and in April issue under 4B, 4C, and 4D.
 1. "Architects' and Builders' Pocket Book," F. E. Kidder.
 2. "Building Construction and Superintendence," Part 1, "Masons' Work," F. E. Kidder.
 3. "Fire Prevention and Fire Protection," J. K. Freitag.
 4. "Fireproofing of Steel Buildings," J. K. Freitag.
- (b) "**Standard Tests for Fireproof Floor Construction**," A.S.T.M., Serial Designation C, 2-08.
- (c) "**Standard Tests for Fireproof Partition Construction**," A.S.T.M., Serial Designation C, 3-09.
- (d) "Report on Inspection of Installation of **Gypsum Slab Construction for Roofs and Floors**," "Public Works of the Navy" (4D1h1).
- (e) "Report on **Loading Test** of a Composition Floor Made by the U. S. Bureau of Standards," "Public Works of the Navy" (4D1h2).
- (f) For "**Composite Floors and Roofs**," see 4D2a1a.
- (g) Report listed under 3A3d31 contains information on "**Floor and Roof Construction**" in a standard building.
- (h) For "**Floor Hangers, Roof Connections and Devices**," see Section 4D4.
- (j) For **Asbestos Building Lumber, Plaster Boards, Partitions, and Gypsum Blocks**, see "List of Inspected Mechanical Appliances," Underwriters' Laboratories (3A6b).
- (k) See Industrial Section for information applicable to **Cement**, pp. 197-199; **Gypsum**, 205; **Metal Lath**, 162-167; **Plaster or Stucco Board**, 196.

11D4 Floor Treatments and Coverings, and Paving (For Tile, see 11C4)

For "Wood Floors and Finishes and Parquetry Work," see 5J and 12E, and for individual units for grounds, see 5G4j.
For concrete floors, underfills and various top coats, and for the treatment of concrete floors and surfaces, see 1E9, 1E10 and 12C.

- (a) Among others, the Portland Cement Association (1E2) has issued the following publications:
 1. "**Suggested Specifications for Concrete Floors**."
 2. "**Specifications for Concrete Roads, Streets and Alleys, with Recommended Practice**."
 3. "**Tennis Courts of Concrete**."
 4. "**Concrete Feeding Floors, Barnyard Pavements and Concrete Walks**."
- (b) See, also, "Suggested Specifications for Concrete Floors," *Engineering-Contracting*, Jan. 24, 1917. (From pamphlet issued by Portland Cement Association.)
- (c) "**Concrete Floors in the Home**," *Scientific American Supplement*, July 8, 1916.
- (d) "Construction of **Concrete Porch Floors and Steps**," *Cement and Engineering News*, Serial beginning October, 1916.
- (e) "**Concrete Floors and Sidewalks**," A. A. Houghton. The construction of square, hexagonal and other forms of mosaic floor and sidewalk blocks or tiling are illustrated and explained.
- (f) See "**Concrete Surfaces**," *Cement and Engineering News*, January, 1917. Illus.
- (g) "**Standard Specifications for Concrete Hardeners**" and, "Standard Specifications for Concrete Floors," of Building Data League are referred to under 4D3c.
- (h) "**Concrete Hardener**," a paper by Mr. P. W. Nelson, *Journal of the Society of Constructors of Federal Buildings*, February, 1917.
- (j) "**Causes of Cracks in Cement Concrete Pavements**," A. T. Goldbeck, *Canadian Engineer*, Jan. 25, 1917. Paper read before American Association for Advancement of Science.
- (k) For "**Terrazzo Floors**," see 2F4a.

- (l) See, also, "A Recent Experience with Terrazzo Work," J. E. Langley, *Journal of Society of Constructors of Federal Buildings*, May, 1915.
- (m) "Investigation of Composition Flooring," R. R. Shively, *Engineering-Contracting*, Sept. 27, 1916. Paper read before the American Chemical Society.
- (n) For a complete exposition of the subject of **Composition Flooring**, see reprint with that title from "Proceedings" of the Engineers' Society of Western Pennsylvania (11A4). 50 cents. This consists of 60 pages, including an address by H. M. Hooker, containing illustrations and many tables relating to all phases, followed with discussions on the subject in general by architects, engineers, and others.
- (o) "**Mastic Floors for Industrial Buildings**," *Engineering-Contracting*, Sept. 27, 1916. Illus.
- (p) For Navy Department Specifications for "**Linoleum**" and other flooring materials, including tiles, see 4D3d.
- (q) "**Asphalt Construction for Pavements and Highways**," C. Richardson. For engineers, contractors, and inspectors. Illus.
- (r) "Latest Advance in the Technology of Asphalt Paving," D. T. Pierce, "Proceedings," Engineers' Club of Phila., Oct. 1916.
- (s) "The Modern Asphalt Pavement," C. Richardson. 580 pp., illus.
- (t) "City Roads and Pavements," W. P. Judson. 197 pp., illus.
- (u) "Specifications for Street Roadway Pavements," S. Whinery.
- (v) Among the standard specifications published by the American Society of Municipal Improvements (11A5), are those for: (1) **Cement Concrete Paving**; (2) **Sheet Asphalt Paving**; (3) **Asphaltic Concrete Paving**.
- (w) "Light Traffic Pavements for Boulevards, Residence Streets and Highways," Linn White and A. C. Schrader, *Journal of the Association of Engineering Societies*, 1912, p. 385.
- (x) For "**Scuppers, Inserts, and Devices**," see 4C4.
- (y) See University of California Bulletin (11C3e) for composition flooring.
- (z) See Industrial Section for information as follows:
 1. Specifications for Flooring Foundations, p. 174, American Materials Co., Inc.
 2. Concrete and Cement Floor Treatments, p. 188, Murphy Varnish Co.
 3. Lapidolith for concrete floors, p. 191, L. Sonneborn Sons, Inc.
 4. Cement Filler and Cement Floor Paints, p. 193, Toch Bros.

11D5 Terms Relating to Plastic Products, Chiefly Plastering

- (a) The following letter from a firm of architects in the Middle West has resulted in correspondence which will lead to further consideration of all structural **nomenclature** by the Institute's Committee on **Materials and Methods** in collaboration with committees in the A.S.T.M., the N.F.P.A., and other bodies.
 "We find a lack of consistency in the use of several words among architects, contractors and manufacturers, and we feel that some committee of the American Institute of Architects should define what certain words would mean when used on the drawings and in the specifications by architects.
 "We find a great deal of difficulty with one in particular, the word "**stucco**." With some it is synonymous with rough-cast plastering; with others it means **moulded plastering** run in place; and then, again, others interpret it as **ornamental plaster**. In our office we refer to rough-finished plastering as "**rough cast**" although the cement manufacturers' literature refers to it as "**stucco**." We refer to plaster work run in place as "**stucco**." We refer to all ornamental plastering which is cast in moulds and fastened in position as "**staff work**."
- (b) The word **stucco** is an old one, originally used in connection with anything run in place, such as moulding, or modeling, or other fine work as distinguished from ordinary plaster surfaces.
- (c) The American Society for Testing Materials in its "Proceedings," Vol. 16, Part I (1916), pp. 452 to 471, gives the **development of definitions, glossary of terms, and a description of all processes** connected with cement, lime, gypsum and all other kinds of mortars, plasters and plastic materials and products under the caption of "Tentative Definition of Terms Relating to the Gypsum Industry—Serial Designation C11-16T." This calls attention to the origin of words now commonly used and the inconsistency with which they are applied to various products and processes.
 In this, **stucco** is described as "a material used in a plastic state to form a hard covering for the exterior walls or other exterior surfaces of any building or structure." The word "**stucco**" is used without regard to the composition of the material, defining only its use and location of its use, as contrasted with the words "plaster" and "mortar."
- (d) The U. S. Bureau of Standards, in Technologic Paper No. 70, says: "The word '**stucco**' as used in this report may be defined as a material used in a plastic state to form a hard coating for

the exterior walls or other exterior surfaces of any building or structure. 'Stucco,' as here used, is a mixture of one or more cementitious materials, with sand or other fillers and with or without other materials, such as hair, coloring matter, etc. The word 'stucco' is used without regard to the composition of the material, defining only its use and location of its use, as contrasted with the words 'plaster' and 'mortar'."

- (e) The Associated Metal Lath Manufacturers have defined "**stucco**" as referring solely to a covering of an exterior wall without regard to the composition of the material.
- (f) The Portland Cement Association, in Bulletin No. 22, on "Portland Cement Stucco," uses the word "**stucco**" to mean a covering of an exterior wall only.
- (g) See "**Nomenclature**" in *Construction*, July, 1917, including letter from Thomas Nolan on that subject.

11D6 Lathing and Plastering

- (See, also, "Shingles, Lathing and Wall Boards", 5K.)
 For correspondence concerning **Lathing Nails**, see 5M3.
 For "Mill Construction Buildings Protected by Metal Lath and Plaster," see 5G2h1.
- (a) For units individually applied to walls and partitions as "**grounds**" before plastering, see reference under 5G4j.
- (b) "**Temporary Grounds for Plastering**," paper by Ernest G. Schurig, illus. *Journal of the Society of Constructors of Federal Buildings*, May, 1916.
- (c) In the March Journal, under 3E3g, brief announcement was made concerning Technologic Paper No. 70, just then received from the Bureau of Standards, entitled "**Durability of Stucco and Plastic Construction**," R. J. Wig, J. C. Pearson, and W. E. Emley. In this connection the following is quoted from Report, Bureau of Standards, 1916:
 "A series of tests, primarily to determine the comparative durability of various types of plastered metal lath on exterior walls, was undertaken in 1911. The results of these tests, obtained from the exposure of small panels, indicated the necessity of carrying out an investigation on a much larger scale. Accordingly, a new and more comprehensive series of tests was planned, the program of which was put into the hands of a cooperating committee, consisting of representatives of the Government, engineering societies, the Associated Metal Lath Manufacturers, the Portland Cement Association, the Gypsum Industries Association, the National Lime Manufacturers' Association, The Hollow Tile Manufacturers Association, and a number of contracting plasterers. The recommendations of this committee were followed in the construction of a test structure (described under 3E3g), and the panels were plastered with a number of typical stuccos, the work being carried out under the supervision of the cooperating committee. No general recommendations are given in the first progress report, nor will such recommendations be attempted until additional test-panels have been erected and an extensive field examination made of stucco houses which have been standing five years or longer. The report, however, contains many illustrations and much suggestive information of value to architects, builders, and prospective home-owners. This report will be amended from year to year as results become available."
- (d) To the original test structure there has been built, since the report was prepared, an addition, which affords twenty-two new panels. These have been constructed in accordance with specifications prepared on the basis of suggestions resulting from developments in the original test-panels. Quite recently three additional stucco buildings have been built for purposes of emergency testing, and are experimental, so far as the stucco construction is concerned.
- (e) 1. A Committee to **Standardize Architects' Specifications** exists in the Illinois Society of Architects. This Committee called together plastering contractors, manufacturers, and dealers, individually and as representing various associations, and endeavored to secure cooperation in the forming of a joint committee. Emory Stanford Hall, Chairman, furnishes the following notes:
 The proposition has been to get the plasterers and the plastering material dealers to agree on a standard specification for **material and workmanship**; then to have the plastering material men guarantee their material to comply absolutely with the standard specification, stamping their guarantee on the packages or furnishing a certificate with each shipment, with the hope, ultimately, that laws might be enacted which would make it fraud to sell building material under a false label, the same as is the case under the Pure Food and Drug Act with reference to food and drugs. With a known and **acknowledged formula**, it would be a comparatively simple matter to ascertain adulteration of material. With a material complying strictly with an acknowledged specification, it would be a comparatively simple matter to place responsibility for defective workmanship.

STRUCTURAL SERVICE BOOK

The plan further provides that if, on receipt of material at the job, the contractor is not satisfied that same is in accord with standard specifications, then he may notify the architect and material dealer and have samples taken for **analysis**, proceeding with the work only upon the material dealer's instructions. If the analysis proves that the material delivered was in strict accord with standard specifications, then the **responsibility** for results is clearly upon the contractor, whereas, if the material delivered, upon analysis, proves not to have been in strict accord with standard specifications, then the responsibility for results may be properly placed on the material man, and he should be compelled to pay all expense, including labor, of **replacing** any defective work.

The Committee has been recognized by the municipal authorities to the extent that it has been asked to **fix a standard** for common plaster on wood lath, which shall be used as the basis of tests for determining the comparative value of substitute materials.

2. In the "Handbook for Architects and Builders" of the Illinois Society of Architects (11D1g24) will be found "**Standard Rules of the Measurement of Plastering**" adopted by the Employing Plasterers' Association of Chicago. These include also a **Tentative Outline Specification for Lath and Plaster Work**; also **Recommendations, Jurisdiction Claims and Patching of Plastering after other Trades** as well as the city ordinance.
- (f) The Employing Plasterers' Association and the Journeymen Plasterers' Association Local No. 96, of Washington, D. C., through a joint committee are drawing up a **specification for lathing and plastering** which is to be submitted to the Commissioners for incorporation in the Municipal Building Regulations of the District of Columbia.
- (g) In some of the pocket books and other publications listed there will be found descriptions and diagrams pertaining to the use of metal lath. The subject of **supports for suspended ceilings, cornices, beam-effects and vaulting**, etc., is of particular importance and is, perhaps, most fully treated in the four books listed under 11D3a.
- (h) None of these, however, goes into this subject as completely as does the Metal Lath Handbook, which is described, together with many activities of The Associated Metal Lath Manufacturers, under 3C11. In this handbook the subject of supports for metal lath has been covered by diagrams and descriptions showing the **practice recommended with respect to walls, partitions, column and beam coverings, ceilings** and other types of construction. In the case of the latter, and most important feature, several drawings serve to show **Standard Details for Suspended Ceilings** for all types, which are accompanied by notes and recommendations. A detail of cornice and cove furring is also shown.

Illustrations of various types of metal lath are also given, with tables of gauges and weights of each. In this connection attention is called to the fact that The Associated Metal Lath Manufacturers have **standardized the weights per gauge for metal lath** at the figures given on pages xiv and xv in the Industrial Section, where, also, may be found "**Standard Details for Fire Retardant Belt Enclosures and Elevator Shafts Using Metal Lath and Plaster**," and other data. Attention is called to error on page iv of Industrial Section, September issue, where the omission of a decimal point after the first figure in the weight made it, for 24 gauge, appear 340 lbs. per sq. yd. instead of 3.40—likewise with the other weights given.

It is of especial interest to note the attention which these metal lath manufacturers have devoted to the subject of **plastering**, as an indication of the importance which should be attached by all manufacturers, not to their product alone, but to all factors connected with its proper utilization. There will be found in the Handbook:

- "Interior Plastering," "Specifications for Interior Plastering," "Gypsum Plaster on Metal Lath," "Exterior Plastering," "Standard Specifications for Exterior Plastering" (with detail showing recommended construction for outside wall, **omitting sheathing**, and, instead, back plastering metal lath between studs), "**Overcoating**" and "**Fire-stops**."
- (j) The before-described methods of procedure which are being developed for the **supporting and applying of lathing for ceiling construction** are of particular interest in view of the many specifications, some of them governmental, which call for the lath on all suspended ceilings and for all cornices, beam work, vaulting, and false work to be "supported and secured in a rigid, thoroughly satisfactory, and workman-like manner to approval." In consideration of this all too frequent practice, it is no wonder that equitable conditions do not always prevail, even in the estimating, and that controversies frequently arise as to the interpretation of "**stiff**," "**rigid**," "**satisfactory**," "**to approval**" and the other terms which are used instead of

definite instructions or direct reference to a standard to be followed.

- (k) In the case of New York City, for instance, this does not apply, for in its **Building Code** are probably as **complete** and detailed **requirements for ceiling construction and other lathing** as will be found anywhere. Such definite provisions make not alone for that safety which is essential under ordinary conditions, but take into consideration the **additional factors** required under heat expansion in localized fires and plenum conditions in the case of a conflagration. (Referred to in many publications listed under 3E1 and 2.)
 - (l) The **absence of such provisions** in some other cities makes all the more significant and worthy of encouragement the action of, for instance, the "Local 53 for Philadelphia and Vicinity" of the Wood, Wire and Metal Lathers' International Union. This local, which is an affiliate of that listed under 11A16, has recently issued and sent to all architects and contractors in the local district "**Uniform Lathing Specifications**" in which are incorporated some excellent provisions. The point is made that if, when such action is contemplated, it could be taken as a result of conferences with architects, plasterers, and builders, it would insure a more appreciative reception and a more general use than when, as in the case referred to, the specifications bear no address or date and do not contain the endorsement of any other organization or any individual known to the recipient.
 - (m) The Associated Metal Lath Manufacturers have plans and specifications at the Underwriters' Laboratories for making tests of **wire, expanded, and sheet metal lath** upon wooden studs, and joists in the form of fire-retardant partitions and ceilings. In this series of tests the same type of metal lath will be secured to metal studs and to metal members so as to constitute incombustible partitions and incombustible suspended ceilings.
- Under date of Oct. 3, the Commissioner of the Associated Metal Lath Manufacturers has requested the coöperation of the Gypsum Industries Association, in that this Association will undertake to provide a **recommended gypsum plaster** to be used as the plastering material upon the already mentioned types of partitions and ceilings.
- (n) The value of lime as a **wall plaster** depends, not only on its plasticity, but on its ability to retain water, so that it may be spread freely on the absorbent surface of the preceding coat. A method has been devised for measuring this so-called "**working quality**" by spreading the mortar on a standard absorbing surface and adopting a standard means of determining when it has dried out so much that it can no longer be worked.—(Report, Bureau of Standards, 1916.)
 - (o) From "The Painting of Green Plaster," paper by John E. Langley, discussion by Ernest G. Schurig, *Journal of the Society of Constructors of Federal Buildings*, July, 1915, the following is quoted: "One authority (the I.C.S.) in speaking of new walls states: 'It does not appear that any **painting** in oil can, with serviceable effects, be done on **stucco** (and this will apply to plaster also), unless the stucco is **dry**, in itself, and the walls have stood sufficiently long to have given the brickwork the requisite degree of dryness. Stucco, on furred walls, may be painted much sooner than otherwise.' All **masonry walls** should, therefore, be **furred for plastering**, if they are to be painted immediately upon completion of the building."
 - (p) For **list of the publications of the I.C.S.** just referred to, (International Correspondence Schools) and others **bearing upon this section**, see 11D1g, Materials in General.
 - (q) "Building Construction and Superintendence," Part 1: "Masons' Work," F. E. Kidder, contains Chapter XII on "**Lathing and Plastering**," pp. 772-812.
- See, also, Chapter XIII of the above for **specifications on "Lathing and Plastering—ordinary work lathing, plastering, hard wall plasterwork, wire lathing and metal, furring, stiffened wire lathing, metal lath on iron work."** Also on "**Solid Partitions—metal lath and studding**."
- (r) The Committee on **Treatment of Concrete Surfaces** of the American Concrete Institute which has under consideration the development of **specifications for stucco** and for **surface treatments of concrete** will be actively engaged during the coming year in **inspection** of existing structures and in supplementary laboratory and **experimental work**. Chairman, J. C. Pearson, Bureau of Standards.
 - (s) See "**Plain and Decorative Plastering**," William Millar. Has an introductory paragraph entitled "A Glimpse of Its History," G. T. Robinson. 1897.
 - (t) "**Facts about Stucco**," reprinted from "*Pacific Builder*," in *Journal of the Society of Constructors of Federal Buildings*, November, 1914.
- Reference to the above reprint is made in a brief section devoted to "**Stucco**" in Paper No. 189, *Journal of the Society of Constructors of Federal Buildings*, entitled: "Some Suggestions for Improvement of Drawings," H. G. Richey.
- (u) "**Cement Workers and Plasterers'** Edition of the Building Mechanics' Ready Reference Series," H. G. Richey, Superintendent of Construction, U. S. Public Buildings. 458 pp., illus.

For other publications of the American Concrete Institute, see 1E6, 1E7, and 1E9.

- (p) "Standard Specifications for Portland Cement Stucco on Metal Lath, Brick, Tile or Concrete Block," American Concrete Institute. Referred to under 1E7j.
- (w) "The Reasons for Specifying Stucco"—what one architect learned from twenty years' special study—the result of practical experimentation in building materials, William Hart Boughton. Printed in *House and Garden*, July, 1917. Illus.
- (x) "Artistic Stucco: Its History and Development and How It Should Be Done," John B. Orr. Presented at annual Convention of American Concrete Institute, February, 1917. Printed in *Concrete*, March, 1917.
- (y) "Solving the Cracking Problem: A score of valuable discussions of the prevention and the removal of hair-checks," briefly abstracted and compiled by Harvey Whipple. Printed in *Concrete*, October, 1917.
- (z) In addition to those elsewhere mentioned, see the publication of the Portland Cement Association, "Portland Cement Stucco."
- (aa) See "Modern Stucco Specifications" of the Atlas Portland Cement Co., contained in an illustrated monograph on Early Stucco Houses of America. (Furnished upon request.)
- (bb) See, also, "Color Tones in Stucco," by the Atlas Portland Cement Co., which reproduces some of the panels in the recent experiments conducted by The Atlas Technical Department in toning stucco with exposed colored aggregates. See further information in the Industrial Section, pp. 198, 199, by Atlas White and Atlas Portland Cement Company.
- (cc) In addition to those previously mentioned, the Hydrated Lime Bureau publishes the following:
 1. "Standard Plaster for Hospital and School Construction," Bulletin G3.
 2. "Hydrated Lime Plaster for Scratch and Brown Coats," Pamphlet G.
 3. "Auditorium Acoustics," Bulletin G4.
- (dd) See "Better Plastering and Better Acoustics," Lawrence Hitchcock. 1915. A treatise on interior plastering. 36 pp., illus.
- (ee) Brief reference to acoustics is also made in the Metal Lath Handbook (11D64).
- (ff) "Hydrated Lime and Its Qualifications as a Structural Material," Bela Nagy. "Proceedings," Engineers' Society of Western Pennsylvania for October, 1917.
- (gg) "Rigid Forms for Reinforced Concrete to Obtain Better Results in Plastering," Ernest G. Schurig, *Journal of Society of Constructors of Federal Buildings*, November, 1915. Illus.

- (hh) "Plastering," W. Kemp. A compendium of plain and ornamental plaster work.
- (jj) "Automatic Stucco and Plastering Machine," Ludwig Eisenkramer, *Journal*, Engineers Club of St. Louis, May, 1916. Illus.
- (kk) "Gypsum Plasters," address by Charles F. Henning before Society of Constructors of Federal Buildings. Also 4D1j.
- (ll) For Sand and Gravel, see "Stone Masonry, Broken Stone, Sand and Gravel," 2C to 2C6, inclusive.
- (mm) See, also, "River Sand," E. G. Schurig, Paper No. 222, *Journal of the Society of Constructors of Federal Buildings*, November, 1916.
- (nn) See Industrial Section for information regarding:
 1. *Elastica Stucco*, p. 175, American Materials Co., Inc., and U. S. Materials Co.
 2. *Bishopric Stucco or Plaster Board*, p. 196, The Bishopric Manufacturing Co.
 3. *Cabot's Stucco Stains*, p. 190, Samuel Cabot, Inc.
 4. "R.I.W." *Liquid Konkerit* and Primer, p. 193, Toch Bros.

11D7 "Ornamental and Decorative" Work

See, also, some references in preceding Section.

- (a) "The Art of the Plasterer," George P. Bankart. An account of the decorative development of the craft (chiefly in England), and modern plaster work. 350 pp., illus.
- (b) "Collection Thiebault," A. Thiebault, French sculptor and plastic decorator. A reprint of the best plates from the "Motifs de Decoration Interieure et Exterieur."
- (c) "Plaster Casts," Frank Forrest Frederick, Professor of Art and Design in the University of Illinois. A brief historical review of the art of casting. Directions for making casts by the waste, piece, elastic, and sulphur-mould process, and notes upon clay modeling.
- (d) "Plastic Ornaments," H. Friling. Contains designs for capitals, pillars, friezes, finials, corners, panels, cartouches, shields and many other ornamental details of facades.
- (e) An interesting description of *Fresco* and a discussion of its possibilities is contained in "The New France," October, 1917, under "A Renaissance of Communal Art," Henry Caro-Delvaile.
- (f) "The Timepiece of Shadows," H. S. Spackman. A history of the sun-dial, illustrating many noted sun-dials, with practical rules for construction.

11E Committee Meetings; Field Investigations

1. The following extracts are from a letter to Mr. E. C. Kemper, Executive Secretary A. I. A.

November 1, 1917.

I beg to submit the following condensed account of my attendance at the meetings of Committee C-1 on Cement and of Subcommittee IX, of the American Society for Testing Materials, held in Allentown, Pa., on October 25 and 26 last.

At these meetings I officially represented the A.I.A., which is a member of this Committee C-1 on Cement, and also of Subcommittee IX, of this same Committee.

The function of this Subcommittee IX of Committee C-1 on Cement is to arrange for the publication of the joint conference reports, and the reports of subcommittees, which resulted in the Standard Specifications for Portland Cement, and which represents the work and research of special committees of the American Society of Civil Engineers, the United States Government, the American Society for Testing Materials, the American Railway Engineering Association, and representatives of the American Institute of Architects, the Portland Cement Association, and other affiliated organizations.

The personnel of this Subcommittee IX of Committee C-1 on Cement is as follows: Ernest Ashton, Chairman, Chemical Engineer of the Lehigh Portland Cement Co., Allentown, Pa. R. W. Lesley, Philadelphia, Member of the International Association for Testing Materials. J. M. Porter, Professor of Civil Engineering, Lafayette College, Easton, Pa. Percy H. Wilson, Consulting Engineer, Philadelphia. American Institute of Architects, represented by Thomas Nolan.

The special business of the meetings at Allentown was the discussion of the reports of Subcommittee III (on the Fineness of Cement) and of Subcommittee VII (on the Strength of Cement). The Subcommittee

VII presented important reports which gave the results of tests continued during the past year. Important conclusions were arrived at resulting from investigations and tests made during the last year which will be of value to the engineering and architectural professions when they are properly revised, classified, and arranged for publication. While reports were submitted by other of the nine Subcommittees of Committee C-1 if the reports of Subcommittees III and VII and IX were made the special order of business.

During a part of the second day of the meetings a visit was made to the cement plant of the Lehigh Portland Cement Co., a few miles out of Allentown, where an opportunity was presented for studying the manufacture of portland cement from the blasting of the stone from the quarries to the loading of the cement in the railroad cars.

Yours very truly,
THOMAS NOLAN,
Chairman, Committee on Materials and Methods of the A.I.A.

2. On October 27, Professor Nolan, as chairman of the Institute's Committee, with D. Knickerbacker Boyd, chairman, and W. L. Plack, a member of the Philadelphia Chapter Subcommittee on Materials and Methods, together with Thomas B. Lippincott, another Philadelphia architect, was one of a party comprising also several prominent local plasterers and lathers who accompanied J. C. Pearson, of the Bureau of Standards, J. J. Earley, of the cooperating committee referred to under 11D6c, and others in making a field examination of stucco, cast-stone, cement-work and plastering in the vicinity of Philadelphia. This investigation will be one of many contributing its results to the amplification of the Bureau of Standards' Report on "Durability of Stucco and Plastic Construction."

Serial No. 12

PAINTS AND PAINTING, GLASS AND GLAZING, AND CONCLUDING SECTION, 1917

DECEMBER, 1917

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12A Associations, Societies and Allied Interests

The publications and activities of the following bodies and of any of the governmental departments concerned with Paint, Varnish, Glass, and other products treated will be mentioned in connection with the main subject heading or subdivision under which they would naturally fall.

1. PAINT MANUFACTURERS' ASSOCIATION OF THE U. S.
Secretary: G. B. Heckel, The Bourse, Philadelphia, Pa.
[Mr. Heckel is Secretary of the Educational Bureau and H. A. Gardner is Director of the Scientific Section of same.]
2. THE INSTITUTE OF INDUSTRIAL RESEARCH
Secretary: P. H. Butler, Washington, D. C.
3. NATIONAL VARNISH MANUFACTURERS' ASSOCIATION
Secretary: G. B. Heckel, The Bourse, Philadelphia, Pa.
4. NATIONAL PAINT, OIL AND VARNISH ASSOCIATION
Secretary: Henry W. Sawyer, 100 William Street, New York City.

5. INTERNATIONAL ASSOCIATION OF MASTER HOUSE PAINTERS AND DECORATORS OF THE U. S. AND CANADA
Secretary: A. H. McGhan, Southern Building, Washington, D. C.
6. PAINT JOBBERS' ASSOCIATION. Secretary: E. R. Drake, Chicago, Ill.
7. BROTHERHOOD OF PAINTERS, DECORATORS AND PAPERHANGERS OF AMERICA. (See, also, American Federation of Labor, 12J117.)
Secretary: J. C. Skemp, LaFayette, Ind.
8. THE NATIONAL GLASS DISTRIBUTORS' ASSOCIATION
Secretary: T. James Fernley, 505 Arch Street, Philadelphia, Pa.
9. THE PLATE GLASS MANUFACTURERS OF AMERICA
Eastern Representative: G. Osgood Andrews, 393-95 Canal Street, New York City.
Western Representative: M. G. Holding, Harris Trust Bldg., Chicago.
10. THE NATIONAL ORNAMENTAL GLASS MANUFACTURERS' ASSOCIATION OF THE U. S. AND CANADA
J. E. Flanagan (Editor), 152 West Chestnut Street, Chicago, Ill.
11. RAILWAY BRIDGE AND BUILDING PAINTERS' ASSOCIATION

12B Research, Tests and Paint Materials

Reference was made under 1F8 to investigational work, with respect particularly to the preservation of iron and steel, which has for years been conducted by the American Society for Testing Materials and the Paint Manufacturers' Association of the U. S., separately and in coöperation. The U. S. Bureau of Standards has also made investigations and is conducting tests. The progress reports and publications pertaining to these activities constitute a most interesting story, even to laymen.

Reference was also made under 3A1 to researches and investigations by all the technical bureaus of the Navy, the conclusions drawn from which result in the various specifications, Index to which is there mentioned.

In connection with this section see Waterproofing and Dampproofing 1D, also Bituminous Materials 11C2.

1 U. S. Bureau of Standards

The following excerpts are given from the current Report of the Bureau, 1916.

- (a) There are a number of apparently very important and little understood physical and physical-chemical problems relating to paints which demand investigation by an experienced and able chemist. Among these phenomena may be mentioned apparent great differences in the effects of different liquids on the surface of finely divided solids, such as pigments, changes in viscosity or plasticity of paints in keeping, or on addition of substances which are, so far as known, chemically inert.
- (b) The paint-exposure tests, begun over a year ago, are in progress, but several years may elapse before conclusions can be drawn. A record will be kept by means of photographs and inspection of the test panels, which, in three kinds of wood, have been painted with a number of well-known brands of white paints for outside exposure.
- (c) A method for the determination of oil and resin in varnish . . . and for the detection of resin in driers . . . has been worked out at the Bureau, which is believed to be more reliable than

any previously published method. (See Technologic Paper No. 66.)

- (d) An investigation of the constants of linseed oil mixed in paste form with white lead and zinc indicates that no material changes take place when the pastes are kept in closed cans. The results of this investigation are embodied in Technologic Paper No. 71.
- (e) In Technologic Paper No. 76 it is shown that for the determination of volatile thinner in oil varnish, any one of a number of proposed methods yields results that are sufficiently accurate for ordinary purposes.
- (f) The electrical division of the Bureau is testing an insulating varnish, prepared in the chemistry division, after considerable work extended over a period of several months. The varnish is made from tung oil, calcium resinate, cellulose acetate, acetone, and pyridene or other organic base.
- (g) A large amount of matter has been prepared for use in a projected circular of information on paint materials.
- (h) A chapter on paint, paint oils, and varnishes has been prepared for the projected circular on household materials.
[NOTE.—We are advised, Nov. 19, 1917, by Director Stratton that it will probably be some time before (g) and (h) are available for distribution.]

2 American Society for Testing Materials

- (a) Committee D1 on Preservative Coatings for Structural Materials, P. H. Walker, Chairman, Bureau of Standards, Washington, D. C., is one of the dominating factors in this country with respect to all matters concerning paint and other coatings. It consists of ninety-one members drawn from authorities in the producing and non-producing fields, and includes representatives from the Bureau of Construction and Repair, U. S. Navy, Underwriters' Laboratories, Maintenance of Way Divisions of Railroads, Paint Manufacturers' Associa-

tion of the U. S., National Varnish Association, chemists, manufacturers and others.

An excellent idea of its work may be obtained from the "Statement of Plan and Policy of Committee D1," pp. 685-689 in A.S.T.M. Book of Standards, 1916.

The range of the subjects covered are indicated by the character of its subcommittees, named as follows: Advisory, Testing of Paint Vehicles, Linseed Oil, Definitions of Terms Used in Paint Specifications, Accelerated Tests and the Influence of Pigments on Corrosion, Methods and Analysis of Paint Materials, Varnish, Paint Thinners Other Than Turpentine, Turpentine, Shellac, Preparation of Iron and Steel Surfaces for Painting, Specifications for Pigments Dry and in Oil When Marketed in the Form, Terms used in Reporting the Condition of Painted Surfaces, Testing of Pigments for Fineness by the Use of Screens, Physical Properties of Paint Materials.

- (b) There were formerly subcommittees on Inspection of Havre de Grace Bridge, on Inspection of Steel Plates at Atlantic City, and on Inspection of White Paint Test Fence at Washington, D.C., but these were discontinued in 1916, their duties having been performed.

The reports of these Committees printed in A.S.T.M. Proceedings previous to that date form interesting documentary records of these tests and of examinations also made by the leading railroads of the country and others interested.

- (c) The most extensive series of panel paint tests ever conducted were those located at the Experimental Farm of the U. S. Department of Agriculture at Arlington, Va. At this place over one hundred white paints of different compositions, used upon lumber surfaces, were exposed in 1912. The tests, to be typical, were located in the center of farming lands, within close proximity to a river and a railroad. Inspections of the tests were annually made and reported to the Society.
- (d) The exhaustive reports of Committee D1 are always a feature of the conventions of the A.S.T.M. and of the published Proceedings (1A4), in addition to which these reports have been issued as a separate bound volume as mentioned under 1F8.

3 Standards Adopted

See, also, the A.S.T.M. Standards under 11C2a.

- (a) Standard Definitions of Terms Relating to Paint Specifications (A.S.T.M. Serial Designation D 16-15). All architects and other specifiers and users of paints and allied products should certainly familiarize themselves with the terms here given as relating to various materials, processes, and methods of application and endeavor through usage and constructive criticism, or suggestions for amplification and additions, to still further crystallize understanding of these subjects. (See, also, (b) next.)
- (b) The Paint Manufacturers' Association at its meeting, November 1916, adopted Definitions and Nomenclature to replace manufacturers' titles or trade-names in common use, consonant with (a), and issues Circular No. 42, 4 pp., giving same.
- (c) Standard Specifications for Purity of Raw Linseed Oil from North American Seed. A.S.T.M. serial designation D1-15.
- (d) Standard Specifications for Purity of Boiled Linseed Oil from North American Seed. A.S.T.M. serial designation D11-15.
- (e) Standard Specifications for Purity of Raw Tung Oil. A.S.T.M. serial designation D 12-16.
- (f) Standard Specifications for Turpentine. A.S.T.M. serial designation D 13-15.
- (g) Standard Tests for Paint Thinners other than Turpentine. A.S.T.M. serial designation D 28-17.
- (h) Standard Tests for Shellac. A.S.T.M. serial designation D 29-17.
- (j) Standard Methods for Routine Analysis of White Pigments. A.S.T.M. serial designation D 34-17.
- (k) Standard Methods for Sampling and Analysis of Creosote Oil. A.S.T.M. serial designation D 38-17.
- (l) Tentative Tests for Analysis of Creosote Oil. A.S.T.M. serial designation D 38-17 T. To be added, when adopted, to the Standard Methods for Sampling and Analysis of Creosote Oil (A.S.T.M. serial designation D 38-17).
- (m) For specifications for Red Lead (dry and paste), and other paint materials as issued by U. S. Navy Department, see "Index" (3A121). Classification 52 consists of "Paints, Alcohol, Cements and Enamels (Navy Formulas), paint oils, pigments, pitch, rosin, tar, turpentine, varnishes."
- (n) For U. S. Army Specifications (for Prepared Paints), see 12E1.

4 Paint Manufacturers' Association of the U. S.

This Association maintains an Educational Bureau, instituted in 1904, which was in 1906 subdivided into three sections: A Scientific Section to have charge of research work and demonstration; a Professional Section to have charge of lecture work; and a Publicity Section to have charge of newspaper, circular, and similar work.

- (a) In "The Educational Bureau—A Résumé of Its Activities from Its Establishment to the Present Time (1915)," will be found

historical data concerning various tests conducted by the Association or in cooperation with the U. S. Forest Products Laboratory, the American Society for Testing Materials, the Southern Cypress Manufacturers' Association, colleges, technical institutions, and others, at Fargo, N.D., Pittsburgh, Pa., Atlantic City, N. J., Nashville, Tenn., Washington, D.C., Manhattan, Kan., St. Louis, Mo., and elsewhere.

The results of all these tests at different stages are published in one form or another by the Association and may be found on the list of publications, with prices, obtainable from its Secretary. Many of them are also referred to in the Proceedings of the A.S.T.M. and other publications, particularly in (b) and (c).

- (b) "Paint Researches and Their Practical Application," H. A. Gardner, Director Scientific Section P.M.A., and Assistant Director of the Institute of Industrial Research. Dedicated, 1917, to past and present members, Educational Bureau, P.M.A. Describes the tests elsewhere referred to and draws deductions to date from the results; contains chapters on prepared paint and pigment industries, physical characteristics, etc., and others that will be found referred to under the subdivisions in this issue.
- (c) "Paint Technology and Tests," H. A. Gardner. Presents results of exposure tests and research work for the Scientific Section of the P.M.A. 256 pp., illus.

5 The Institute of Industrial Research

The Division of Paint Technology is under the direction of H. A. Gardner, who has long been in charge of the experimental work carried on by the Paint Manufacturers' Association, which is being continued in the paint laboratories of the P.M.A. at the Institute.

The extensive exposure tests in different sections of this country, which were designed to determine the comparative merits of protective coatings and paint products for various structural materials, are being continued and inspected from time to time in order that reports and bulletins may be issued and information distributed, in conjunction with important laboratory researches to determine the physical and chemical properties of oils and oil mixtures.

Bulletin No. 3 describes the scope and organization of the Institute and contains a list of publications issued by it or under its auspices.

- 6. In "The Specifying of Paints and Varnishes," in *The American Architect*, Oct. 3, 1917, G. B. Heckel writes: "Beyond the painter as a basis for intelligent specification stands experience. . . . It would seem imperative, therefore that the practising architect should have always in progress a series of field tests systematically examined and reported on at regular intervals. . . . Better still would it be if the American Institute of Architects, for example, through a standing committee should conduct such tests continuously for the benefit of the entire craft, issuing from time to time lists of approved brands or materials. One can easily conceive how such a committee or organization might eventually speak with authority on the entire range of products and materials. There is such an organization now in operation in New York (Building Data League) and, if wisely conducted and developed, it should accomplish much."
- 7. See references under "Manufacture of Oils and Pigments" (1F8c).
- 8. See "Paints and Pigments," A. H. Sabin, *Journal*, Association of Engineering Societies. 1911.
- 9. "The Analysis of Paints and Painting Materials," H. A. Gardner and J. A. Schaeffer.
- 10. "White Paints and Painting Materials," W. G. Scott. A treatise on source and manufacture, composition and properties, use and formulas. 493 pp.
- 11. See "Painters' Colors, Oils and Varnishes," George H. Hurst.
- 12. "American Civil Engineers' Pocket Book," M. Merriman, 1916, section on "Paints and Oils," p. 374.
- 13. "Paint and Painting," P. W. Nelson, *Journal*, Society of Constructors of Federal Buildings, February, 1917.
- 14. See "Students' Handbook of Paints, Colors, Oils and Varnishes," J. Furnell. 94 pp., illus.
- 15. "Simple Method for Testing Painters' Materials," A. C. Wright. 160 pp., illus.
- 16. "Pigments, Paints and Painting," George Terry. 392 pp., illus.
- 17. "The Industrial and Artistic Technology of Paint and Varnish," A. H. Sabin. 372 pp., illus.
- 18. "Chemistry and Technology of Paints," Maximilian Toch. 373 pp., illus.
- 19. "Drying Oils, Boiled Oil, and Solid and Liquid Driers," L. E. Andes. 356 pp., illus.
- 20. "The Manufacture of Paint," J. C. Smith. 285 pp., illus.
- 21. "The Manufacture and Comparative Merits of White Lead and Zinc White Paints," G. Petit. 103 pp.
- 22. "Manufacture of Varnishes and Kindred Industries," J. G. McIntosh. Illus. Three volumes.
- 23. "Dictionary of Chemicals and Raw Products Used in the Manufacture of Paints, Colors, Varnishes and Allied Preparations," G. H. Hurst. 392 pp.

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24. "Paint and Varnish Facts and Formulas," J. N. Hoff. 179 pp.
25. "Chemistry of Paints and Paint Vehicles," C. H. Hall. Illus.
26. "Linseed Oil and Other Seed Oils," Wm. D. Ennis. 330 pp.

27. For references in Industrial Section applicable to this division, see:
 - (a) **Inspection Service, Laboratory Service**, Robert W. Hunt & Company, pp. 142-144.
 - (b) **Matheson White Lead**, Matheson Lead Company, p. 195.

12C Treatments and Coatings for Metals and for Walls and Floors, Exclusive of Wood

See Preservation of Iron and Steel (1F8); Protective Coatings (1F8b); Corrosion and Treatment of Metals (11B2); and, Protective Coatings (11B3). Also, as of interest, see Floor Treatments and Coverings (11D4) and reference to Committee on Treatment of Concrete Surfaces (11D6r). See, also, 12E7 and 9; also 1D and 11C2.

1. In "Paint Researches and Their Practical Application" (12B4b) see Chapters: VI—Paint Protection for Portland Cement Surfaces; VII—Paints to Prevent Electrolysis in Concrete Structures; VIII—Paints for Metal (this includes recommendations for painting galvanized iron, and painting tinned surfaces); IX—Marine Paints (includes preservation of tanks); XVI—The Light Reflecting Values of White and Colored Paints (this includes a page of colored samples giving the coefficients of reflection of various wall colors compared with a block of white magnesium carbonate).
2. Lefax Data Sheet, 6-224, "Paints for Metal Surfaces," contains information from Chapter VIII of above.
3. See "Building Code" recommended by the N.B.F.U., 1915, for "Protection of Structural Metal against Corrosion," p. 96.
4. See requirements for Shop Painting of steel work, Manual American Railway Engineering Association, 1915 edition, p. 503.
5. "Red Lead Paints for Metal Surfaces," G. W. Thompson, *Metal Worker*, Jan. 19, 1917.
6. The Painting of Iron and Steel," J. Scott, *Railway Engineering*, June, 1916. Illus.
7. "Paints to Prevent Electrolysis in Concrete Structures," H. A. Gardner, *Journal*, Franklin Institute, March, 1915. 24 pp.
8. See "Mechanical Engineers' Pocket Book," Wm. Kent, 1916, for information on Roof Paints, p. 192; Chrome Paints, p. 469.
9. See "American Civil Engineers' Pocket Book," M. Merriman, 1916, for painting of structural steel, paints commonly used for painting steel in buildings, and paint for steel bridges.
10. See "Civil Engineers' Pocket Book," J. C. Trautwine, 1913, regarding paint coatings for iron, zinc, bridges, and concrete.
11. See "I.C.S. Building Trades' Handbook," for information on fire-proofing and painting of metal columns, p. 120; and for painting of tin roofs, p. 312.
12. Among the Miscellaneous Rules in the "Hand Book of Fire Protection," E. U. Crosby and H. A. Fiske, is one on Painting and Bronzing (p. 340), which says: "Where pipes are painted or bronzed for appearance, the moving parts of sprinkler heads should not be so coated."
13. Paint for Steam and Hot Water Radiators, Circular No. 7, P.M.A., 1913, gives a résumé and tables showing results of investigations conducted by Prof. J. P. Allen at University of Michigan (see, also, 10K2b) in which it is stated that "aluminum, copper and metal pigments in bronzes reduce the heat transmission." Results of these "Transmission Values" given also in a table on p. 1247, Kidder's Pocket Book 1916. These tests also described in "Painting School Buildings," S. B. Heckel in *School Board Journal*, November, 1917, in which is also described treatment of other special surfaces.
14. "Technical Paints," A. H. Rhett, *Journal of Society of Constructors of Federal Buildings*, February, 1917.
15. For labor applying waterproof paints, see "The Building Estimator's Reference Book," Frank R. Walker, Chapter IV on "Water- and Damp-Proofing."
16. In 1909, in Philadelphia, the Educational Bureau, P.M.A., instituted a series of tests on cement coatings. See Bulletin No. 20 on Cement Paints.
17. In 1912, the Bureau Laboratories having been transferred to the Institute of Industrial Research at Washington, a concrete test fence was erected there for the testing of cement coatings. The general results of the tests at the end of a two-year period, in "Paint Researches and Their Practical Application" (12B4b).
18. In 1910 a series of similar tests was instituted on the concrete walls and floors of the Institute building itself. The results are given in Circular No. 24, Educational Bureau, P.M.A., and in a paper, entitled: "Paint Protection for Portland Cement Surfaces," presented by H. A. Gardner to the A.S.T.M. in 1914.
19. The results of these tests are quite in line with the results obtained by Ware and Schott. (See "Paint Films as Protective Coatings for Concrete," *Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 3, March, 1914) in a series of paint-exposure tests made upon exterior concrete surfaces.
20. The Building Data League (2A5) has issued the following:
 - (a) "Standard Specifications for Concrete Hardeners," No. 598, "Liquid Penetrating Coatings," No. 902, "Incorporated Additions."
 - (b) "Standard Specifications for Damp-proofing Exterior Walls above Grade," No. 395-1.
 - (c) News Letter, July, 1917. 4-page digest of paper by Bassett Jones on "The Characteristics of Interior Building Finishes as Affecting Illumination—to show the real economy in applying finish to walls and ceilings that will make them permanently efficient as reflecting surfaces and how such finishes may be produced."
21. See article on "The Economic Value of Mill Whites" in *Textile World Journal*, June 2, 1917.
22. In *Journal of Society of Constructors of Federal Buildings*, see,
 1. "The Painting of Green Plaster," J. E. Langley; discussion by E. G. Schurig. July, 1915; also in May, 1916.
 2. "My First Experience with Distemper," C. M. Pritchett.
23. "Paint and Painting" (12B13) contains information on "Paintings of Interior Surfaces of Ceilings and Walls."
24. For "Government Whitewash" Formulas, see 2Bg9d.
25. See "Navy Department Specifications" (3A14) for Cold Water Paint, Aluminum Paint and Copper Paint.
26. For references in Industrial Section applicable to this division, see:
 - (a) "A Rust-proofing Process, Patton's Ironhide," p. 194.
 - (b) R. I. W. Protective Products, Toch Brothers, p. 193.
 - (c) Solvay Protective Paints, The Solvay Process Co., Smet-Solvay Co., p. 192.
 - (d) "Lapidolith" for Floors, "Cemcoat" for Walls, L. Sonneborn Sons, Inc., p. 191.
 - (e) Brick and Stucco Stains, Samuel Cabot, Inc., p. 190.
 - (f) "Konkreto," for floors, walls and ceilings, Murphy Varnish Co., pp. 188, 189.
 - (g) Inspection and Laboratory Services, Robert W. Hunt & Company, pp. 142-144.

12D Wood Preservatives, Shingle Treatments and Fire-Retardants

See "Treatments of Woods: Preservatives and Fire-Retardants" (5E1), and, "Piling, Piers, and Bulkheads" (5F).

See, also, "Treated Wood Flooring and Paving" (5E2).

1. "Specifications for the Purchase and Preservation of Treatable Timbers," from Report to American Wood Preservers' Association; *Railway Age Gazette*, Jan. 26, 1917.
2. See *Journal of the Association of Engineering Societies* for the following papers:
 - (a) "Paints for Preservation of Wood and Metal Structures," Onward Bates, 1898, p. 1168.
 - (b) "Preservation of Timber," Samuel M. Rowe, 1899, p. 283.
 - (c) "Preservative Treatment of Timber," O. Chanute, 1900.
 - (d) "The Preservation of Railroad Cross Ties" (abstract), 1900.
 - (e) "Preservation of Timber from Decay" (bibliography), 1900.
 - (f) "Factors Which Cause the Decay of Wood," Hermann von Schrenk, 1901, p. 89.
 - (g) "Timber Treating Plants," W. W. Curtis, 1903, p. 541.
 - (h) "Preservation of Wood from Fire and Decay," Joseph L. Ferrell, 1904, p. 38.
 - (j) "Wood Preservation from an Engineering Standpoint," C. T. Barnum, 1910, p. 346.
3. In "Paint Researches and Their Practical Application" (12B4b), see Chapters: XII—Impregnated Panel Tests; XIII—Fire-Retardant Paints for Shingles and Other Wooden Structures.
4. "Test Compounds for Making Wood Fire-Retardant," *Engineering Record*, June 17, 1916.
5. In cooperation with the National Lumber Manufacturers' Association and others, a series of tests was instituted by the Educational Bureau, P.M.A., in 1912, on Fire-Retardant Shingle Paints, and a preliminary report was made thereon in Bulletin No. 42. Later the Scientific Section, at the suggestion of the U. S. Forest Products Laboratories, prepared three series of tests in duplicate, which were exposed in Washington, St. Louis, and Atlantic City. These comprise both impregnated and unimpregnated woods, panels for which were prepared by the Forest Products Laboratories. The test is described in Bulletin No. 44. The final report is now in course of preparation by Dr. von Schrenk.

The results of these tests have led to the manufacture of fire-retardant shingle paints in accordance with a formula licensed by the P.M.A. of the U. S., the same being known as "Pamak." The Educational Bureau of the P.M.A. has just issued a leaflet containing information on this subject and a list of manufacturers licensed to manufacture fire-retardant shingle paints under the official trade-marks of the Association.

6. "Woods treated either with antiseptic materials, for purpose of preservation, or with chemical salts, to render them fire-resistant, are coming into general use. In conjunction with the United States Forest Products Laboratory, the lumber associations, etc., the Scientific Section of the P.M.A. is investigating the proper method of painting wood so treated. The work is described in Bulletin No. 44 and in the Section Reports."

7. See "Fire Prevention and Fire Protection," J. K. Freitag, 1912, "Fireproof Wood," p. 260; **Fire-retarding Paints**, p. 938.
8. See, "Hand Book of Fire Protection," E. U. Crosby and H. A. Fiske, **Fire-Retardant Paints**, pp. 81-82.
9. "Notes on Preservation of Wood—Some Microscopic Features," James Scott, *Railway Engineer*, January, 1917, illus.
10. "The Preservation of Structural Timber," H. F. Weiss. 361 pp., illus.
11. "American Civil Engineers' Pocket Book," M. Merriman, 1916, **painting of drydocks**, p. 1476.
12. See Index to Navy Department Specifications (3A1a1), Classification 52.
13. For references in Industrial Section applicable to this division, see:
 - (a) **Cabot's Old Virginia White** for shingles, siding and woodwork **Conserve Wood Preservative**, Samuel Cabot, Inc., p. 190.

12E Painting, Varnishing and Finishing in General

See, also, references to Coatings, Mill-whites, etc., under 12C.

See Index to Navy Department Specifications (3A1a1). Classification 52, consists of **Paints, Alcohol, Cements and Enamels (Navy Formulas), Paint Oils, Pigments, Pitch, Rosin, Tar, Turpentine, Varnishes.**

1. In "Paint Researches and Their Practical Application" (12B4b), see various Chapters, including: XI—Observations on Painted Lumber; XVII—Formation and Inhibition of Mildew in Paints; XVIII—Fungi on Painted Surfaces; XXII—Paint Driers and Their Application; XXIV—The Application of Paints and Finishes to Wood. In the latter Chapter it is stated:
 - (a) "The majority of the high-grade paints to be purchased from reliable dealers will closely approximate the prepared paint called for by the specifications of the U. S. Army, which are as follows:
 - (b) "The paint must be furnished in prepared form, ready for application. White paint must contain not less than 65 per cent nor more than 70 per cent of pigments, the balance to be liquids. The liquids shall consist of pure raw linseed oil, containing a total of not over 10 per cent of turpentine and turpentine drier. The pigment portion of the paint shall consist of white lead (basic carbonate or basic sulphate) and zinc oxide. There shall not be less than 25 per cent nor more than 50 per cent by weight of zinc oxide. Paints of this composition containing, in addition, not over 15 per cent by weight of such white pigments as barytes, china clay, whiting, asbestine, and silica will be accepted under these specifications."
2. The P.M.A. of the U. S. (12A1) issues circulars, bulletins of the Scientific Section, tabloids, pamphlets and booklets. Many of these are of special interest to architects and constructionists.
3. At its Convention, on Nov. 16 and 17, 1917, the P. M. A. of the U. S. took the following action:
 - To reduce the number of paints and shades offered on color lists to a maximum of 42, exclusive of black and white. (Some of the leading manufacturers have already reduced to 36.)
 - To eliminate the half-gallon can for all paint products on and after July 1, 1918. (The varnish manufacturers are expected also to fall in line with this action.)
 - To eliminate the pint can at the same time for liquid house paints.
4. The National Paint, Oil and Varnish Association issues a Year Book and Bulletin to members and maintains a Bureau for the registration of trade names and trade titles, having over 5,000 listed.
5. The "International Association of Master House Painters and Decorators of the U. S. and Canada" (12A5) is devoting particular attention to the trade education of the youth through a special committee and has a Paint Legislative Committee of which John Dewar, of Pittsburgh, is Chairman, which is actively agitating for a Federal law requiring the plain paint label with a correct analysis attached to all packages.
 - (a) NOTE.—This activity is along the lines of the action of the American Institute of Architects at its 1916 Convention in Minneapolis in adopting Mr. Tomlinson's motion that "the Committee on Materials and Methods, or another, be instructed to work for Federal legislation analogous to that governing weights and measures or to that governing pure foods which shall provide penalties for furnishing other than the kinds and qualities of materials, or the weights and measures required under specifications and contracts."—"Proceedings" Fiftieth Annual Convention A.I.A., p. 28.

(The P.M.A. is opposed to the formula on practical grounds but advocates the passage of laws forbidding any form of misbranding and requiring statement of net weights or measure similar to those now in operation in Pennsylvania, Ohio, and some other states.)

- (b) At the next Convention of this Association (12A5) at Peoria, Feb. 5-8, 1918, Prof. E. F. Ladd, President of the Agricul-

tural College of North Dakota, under whose auspices the first paint-test fence in this country was erected, will deliver an address on "Paint and Paint Materials."

6. The Brotherhood of Painters, Decorators and Paperhangers of America (12A7) issues monthly *The Painter and Decorator*, its official publication, containing items of interest in connection with the craft.
7. "A Paint Catechism for Paint Men," G. B. Heckel, Secretary P.M.A. 48-page booklet. Third Edition. Revised and extended February, 1917. 25 cents. This handy collection of terse, practical definitions of paint materials and answers to questions met in everyday practice will be found helpful to all specifiers and users of paint. It describes Lithophone, Soya Bean Oil, and other products of recent usage and gives recommendations of the kind and character of applications to be made to wood, metal, and other materials under varying conditions.
8. "A Varnish Catechism for Varnish Men," also by Mr. Heckel, is similar in the informative character of its contents to the next preceding reference. 45 pp. 1912. 25 cents.
9. "Painting with Prepared Paint—A Guide for Consumers" is the title of a 32-page booklet reprinted from *Drugs, Oils and Paints*, which may be obtained from the Editor, Bourse Building, Philadelphia. Defines classes of lumber and recommends treatments for each and for new and old work, and for metals (including galvanized iron), bricks, plaster, and other materials.
10. The proper treatment of the woods in which they are interested has naturally appealed to the various lumber interests to the extent that they have issued instructive literature on the subject, much of it in collaboration with painting and varnishing interests, and in some cases under the guidance of individual authorities. Some of the following references merit partial repetition from "Exterior and Interior Wood Finish, Veneering and Finishing" under 5H:
 - (a) In "Lumber and Its Uses" (5B1f) see Section on "Paints and Wood Finishes," describing Preparatory Treatments and giving Specifications of Master Painters for Exteriors, Interiors, Hardwoods, and Softwoods.
 - Southern Pine Association issues:
 - (b) "Directions for Finishing Southern Yellow Pine," 19 pp., containing colored facsimiles of finished woods and other illustrations, including interiors, with notes on painting, staining, and varnishing of this wood.
 - (c) "Service and Economy in Building" (5G2n). Similar in contents to (b) without colored plates.
 - (d) "The Interior of Your Home," 24 pp., 8½ x 10, 1917, containing color plates of Popular Finishes in Southern Pine Interior Trim, many illustrations and descriptions with Directions for Finishing Southern Pine Interiors as to Painting, Enameling, Staining and Natural Finish and as to Floors. Also Painting Exteriors.
 - Gum Lumber Manufacturers' Association issues:
 - (e) "Technical Information about Red Gum" (no date), 16 pp., with notes on the care of hardwood doors and trim.
 - (f) "Red Gum Facts," 13 pp. Formulas for various finishes.
 - California Redwood Association issues:
 - (g) "California Redwood," 70 pp., giving "Directions for Rear Finishes on Redwood." Eight large colored panels show in facsimile varying effects of grain also.
 - (h) "In the Home of Redwood" (5G2m2), formulas are given for Interior finishes.
 - Arkansas Soft Pine Bureau issues:
 - (j) "Arkansas Soft Pine: Interior Trim," 18 pp., colored and other illustrations.
 - (k) "Arkansas Soft Pine: How to Finish and Paint It," 1917.
 - (l) "Not a House but a Home." Hints for the Layman; Cottage and Residence Designs, with introduction by Aymar Embury II, architect. 36 pp.
 - West Coast Lumbermen's Association issues:
 - (m) "Suggestions for the Finishing of Western Woods."

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- North Carolina Pine Association issues:
- (n) "Architects' and Contractors' Reference Book on North Carolina Pine," 7 pp., illus. Contains **colored illustrations**.
 - (o) "North Carolina Pine for Architects and Contractors," 15 pp., colored illustrations of **stained boards**, and adaptability to staining and enameling.
 - (p) "Your Home Beautiful," 16 pp., colored illustrations of **stained boards** and colored interior views.
 - (q) "Planning the New Home," 24 pp. Contains colored illustrations of **stained boards**; exterior illustrations and floor plans of ten modern homes, together with information on the characteristics of this wood.
 - (r) "Architects' Reference Book," 16 pp., color plates.
 - (s) "Home Builders' Book, 24 pp., color plates.
- Southern Cypress Manufacturers' Association issues:
- (t) "Cypress Pocket Library." Consists of 41 booklets covering all uses for Cypress (§G191). See index to same in Vol. 1.
11. The next following publications, some of them issued by the manufacturers of the flooring themselves, and one by a varnish association, refer to the **finishing of wood floors**, the remaining contents having been referred to under §H. (Treated wood flooring and paving referred to under §E2.)
- (a) "The Building Estimator's Reference Book," F. R. Walker, 1917, contains a complete section on **wood flooring**, pp. 1318-1381, which gives data on scraping, sanding, and complete finishing, with several pages of illustrations of **parquet floors and wood carpets**.
 - (b) In "Lumber and Its Uses" (§B1f), see **Hardwood Flooring—Kinds, Grades, Uses and Methods of Finishing**.
 - (c) In "Directions for Finishing Southern Yellow Pine" (§H2), see section on Finishing Southern **Yellow Pine Floors**. Publication of the Maple Flooring Manufacturers' Association:
 - (d) "How to Lay and Finish Maple Floors," 1915. Includes Scraping and Sanding, Directions for Finishing Floors (oil treatment, wax finish, and varnished floors), Repairing Waxed Floors, Staining Maple, Beech and Birch Flooring.
 - (e) Publication of The Oak Manufacturers' Association of the U. S. and the Oak Flooring Service Bureau: "Oak Flooring," Seventh Edition, 1915. Contains Directions for Scraping, Finishing (oil, wax and varnish), **Care of Oak Floors**, and Economical Uses.
 - (f) The National Varnish Manufacturers' Association (12A3) issues (1911) "**Modern Floors**" which treats of Preparation of Surface, Paste Wood Fillers, Staining, Varnishing, Proper Conditions, Refinishing Old Floors and Proper Treatment and Care of Floors. 16 pp.
 - (g) "Care and Operation of Federal Buildings," by J. Morton, *Journal of Society of Constructors of Federal Buildings*, July, 1915, describes the preparation used in Federal buildings for **oiling wood floors**, for preservation of the wood, reduction of dust, and simplification of cleaning.
 - (h) "Laying and Finishing Hardwood Floors," F. G. Odell. 50 pp., illus.
 - (j) The treatment and **finishing of floors** with various materials is described in the Specifications which follow (11 and 12).
12. For "**Specifications on Painters' Work**," and Notes on Painting Specifications, see Part II of "Building Construction and Superintendence," F. E. Kidder, which treats of painting, repainting, staining, varnishing, graining, enameling, finishing and waxing, with regard to: old and new exterior woodwork, brickwork, plaster, cement and concrete; exterior iron and steel; iron fences, and galvanized iron; copper; tin; shingles; interior woodwork and softwoods; interior plaster and cement; hardwoods; pine and hardwood floors.
13. For complete notes and observations on "the Painting, Enameling, Staining and Finishing of Woods Generally—in a Medium and First Class Manner, also for the Painting of Brick, Plaster, Cement Concrete, Iron, etc." see "**Architectural Specifications**," John Dewar. Endorsed by the Pennsylvania State Association of Master House Painters and Decorators, Jan. 15, 1913.
14. See "Kidders' Pocket Book," 1916, "**Paint and Varnish**."
15. "Mechanical Engineers' Pocket Book," Wm. Kent, 1916. Section on "Preservative Coatings," pp. 471-472, describes Paint, Varnishes, Methods of Application, **Quantity of Paint** for a Given Surface, and Qualities of Paints.
16. "Mechanical Engineers' Handbook," Lionel S. Marks. 1916. Section on "**Paints and Protective Coatings**," H. A. Gardner, treats of preparation of surfaces, cost, paints for wooden surfaces, paint oils, carbon paints. See also p. 532 for information on aluminum bronze; p. 627, for insulating varnishes; and p. 643 for shellac.
17. In "Handbook for Architects and Builders," published under the auspices of the Illinois Society of Architects, Vol. XX, 1917, see "**Varnish**," by R. B. Johnson, pp. 341 and 343; also, "**Protective, Preservative and Decorative Coverings**," pp. 345, 351.
18. See "The Building Estimator's Reference Book," F. R. Walker, 1917, Chapter XIX on "**Painting and Varnishing**" for information on the Measurement of Buildings for Painting;
- Covering Capacity of Various Kinds of Paints; Material, Labor and Actual Costs of Painting and Varnishing; Dry, Cement and Oil Colors.**
- 19. See "Civil Engineers' Pocket Book," J. C. Trautwine, 1913, for information on **paints and painting**, and for cost data.
 - 20. See "The Building Foreman's Pocket Book and Ready Reference," H. G. Richey, "**Painting and Glazing**," p. 504.
 - 21. "Cyclopedia of Architecture, Carpentry and Building," American School of Correspondence, Vol. 1, contains information on **Outside Finish, Inside Finish, and Decorating**.
 - 22. See "I.C.S. Building Trades' Handbook," section on "Estimating" for **Painting and Papering**, pp. 372-375.
 - 23. "**Color in Architecture** at the Panama-Pacific Exposition," Wm. L. Woollett, *Architectural Record*, May, 1915. Illus.
 - 24. "The Use of **Paint on the Farm**," P. H. Walker, *Farmers' Bulletin* No. 474, U. S. Department of Agriculture (12H1).
 - 25. In the "Proceedings" of the Municipal Engineers of the City of New York, 1915, will be found a paper by Houston Lowe on "**Some Paint and Painting Factors**," followed by discussions, comprising 39 pages of illustrated data of interest in connection with the use of paints and the maintenance of bridges, buildings, and other structures. In same is given a form of "**Specifications for Mixed Paints for Wood—Outside**," as prepared for the Board of Water Supply, particularly for use on fences and buildings along the Catskill aqueduct.
 - 26. "**House Painting**," Alvah Horton Sabin. 121 pp.
 - 27. "The Preparation and Uses of **White Zinc Paints**," P. Fleury.
 - 28. "**Commercial Paints and Painting**," Arthur S. Jennings. 236 pp.
 - 29. "How to Get Good Results with Paint," G. W. Thompson, *The American Architect*, April, 1915.
 - 30. "**Painting Schoolhouses**," S. B. Heckel, *School Board Journal*, various issues prior to November, 1917. (See 12C13.)
 - 31. "How to Mix Paints," C. Godfrey. Illus.
 - 32. "Paint and Color Mixing," A. S. Jennings.
 - 33. "**Enamels and Enameling**," P. Randau. 196 pp., illus.
 - 34. "**Practical Painters' Work**," Paul N. Hasluck. 160 pp., illus.
 - 35. "**Facts and Figures** in Connection with **Outside Painting**," G. E. Walsh, *House and Garden*, September, 1911. Illus.
 - 36. "**739 Paint Questions Answered**," Wm. T. Comstock. 383 pp. (Reprinted from the *Painters' Magazine*.)
 - 37. "One Thousand More **Paint Questions Answered**," Wm. T. Comstock. 630 pp. (Reprinted from the *Painters' Magazine*.)
 - 38. "Philosophy of **Color**," Chandler R. Clifford.
 - 39. "**Color, Harmony and Contrast**," James Ward. Illus.
 - 40. "Grammar of **Coloring**," G. Field. New edition enlarged by E. A. Davidson.
 - 41. See the following in *Journal of Society of Constructors of Federal Buildings*:
 - (a) "The **Priming Coat**," Harry G. Richey, May, 1915.
 - (b) "The Painting of **Green Plaster**," July, 1915.
 - (c) "**High Grade Varnishes; Their Manufacture and Use**," C. T. Bragg, March, 1915.
 - (d) "**Fumed Oak**," C. E. Morrell, November, 1915.
 - (e) "**Transparent Finishes**," E. G. Schurig, July, 1915.
 - 42. Lefax Data Sheet, 6-303, "**Light-Reflecting Values of White and Colored Paints**," contains material from Chapter XVI of "Paint Researches and Their Practical Application" (12B4b).
 - 43. In "What You Should Know When Building A Little House," C. E. White, Jr., see the following: "**Finishing the Interior**," p. 26; and Painting and Finishing of Trim on the back, p. 27.
 - 44. "Architectural **Hardwood Finisher**," Geo. Whigelt.
 - 45. "**Natural Woods and How to Finish**," Wm. T. Comstock.
 - 46. "The Modern Wood Finisher," F. Maire.
 - 47. "The Up-To-Date **Hardwood Finisher**," F. T. Hodgson, *Architect*, 320 pp., illus.
 - 48. "**Wood-Finishing**," Paul N. Hasluck.
 - 49. "The **Hardwood Finisher**," C. Godfrey. 112 pp., illus.
 - 50. "**Polishes and Stains for Wood**," D. Denning.
 - 51. "Care and Operation of Federal Buildings" (12E10g). See p. 231 for reference to Treasury Department's formula for **furniture polish**, and to other preparations for the **removal of ink and grease stains** from varnished surfaces.
 - 52. "Painting for the Imitation of Woods and Marbles," as taught and practised by A. R. Van der Burg and P. Van der Burg. Illus.
 - 53. "Practical **Graining and Marbling**," Paul N. Hasluck. 160 pp.
 - 54. "French **Polishing and Enameling**," R. Bitmead.
 - 55. "Painter, Gilder and Varnisher's Companion," Wm. T. Comstock.
 - 56. "Modern Mural Decoration," A. Lys Baldry. Illus.
 - 57. "House **Decorating and Painting**," W. N. Brown. 150 pp., illus.
 - 58. "Three Hundred Shades and How to Mix Them," A. Desaint.
 - 59. "House **Painting, Glazing, Paper-Hanging and White Washing**," A. H. Sabin. 121 pp.
 - 60. The following will be found in *House and Garden*:
 - (a) "**Papering and Painting Problems**," H. D. Eberlein, March, 1914. Illus.
 - (b) "**Color Schemes in Exterior Paint**," Suggestions for Painting the New House and Re-Painting the Old, A. A. Kelly, February, 1917.

- (c) "Thirty-six Facts about Color," The Fundamental Principles Governing Color Selection and Color Arrangement in a Room, October, 1917.
- (d) "The Return of the Painted Panel," Its effective Use in the Modern Room—Other Suggestions for Paneled Wall Treatment, A. Foster, January, 1916. Illus.
- 61. See *The Journal of the Franklin Institute* for various papers read before the Society applicable to all phases of painting.
- 62. For references in Industrial Section applicable to this main heading, see:
 - (a) *Architectural Varnishes*, list of Publications, and Specifications for Wood Finishing, Murphy Varnish Co., pp. 188, 189.
 - (b) *Matheson White Lead*, Matheson Lead Co., p. 195.

12F1 Glass and Glazing in General

- (a) *The National Glass Distributors Association* (12A8) has issued, 1916, "Glass and Glazing," a 46-page booklet, "to present to the users of glass a standard or guide for the architect, owner, or contractor, by which the material may be better known and more readily understood."

It contains brief instructive and interesting descriptions of the process of manufacture of various kinds of glass, and gives the commercial thickness and size and the terms used in designating the different grades and qualities, the characteristics of which are defined. It also includes notes on **installation**, **puttying**, and many pages illustrating various kinds of glass and gives tables of **maximum sizes**, **thicknesses**, and **approximate weights**.

Among the kinds referred to are: **Plate Glass**, including Special Quality and Beveling and Wheel-cut Mitred Work; **Mirrors**; **Window Glass**, including Crystal Sheet; **Bent Glass**; **Glazing**, including Appeal to Architects; **Metal Store Front Construction**; **Leaded Glass**; **Wire Glass**, including Underwriters' Requirements and illustrations of typical patterns or surfaces; **Rolled Figured Glass**, with illustrations of kinds; **Ornamental Polished Plate Prismatic Glass**; **Prism Glass**; **Sidewalk Glass**; **Skylight**, **Floorlight**, **Milk-white**, **Opalite**, **Vitrallite**, **Carrara**, **Chipping and Grinding**, **Enamelling**, **Embossing**, **Etching Colored Glass**, all except the latter containing illustrations appropriate to each section.

- (b) *The Plate Glass Manufacturers of America* (12A9) issue a 12-page booklet called "Plate Glass" which is in large part similar in context to the plate-glass section of Glass and Glazing and bears the imprint, "Issued by Permission of The National Glass Distributors Association." It contains, however, additional material relating to **Sizes and Thicknesses**, under which it is stated: "Polished plate glass is manufactured in thicknesses ranging from 5/16" to 1 1/2". The standard product runs from 1/4" to 5/16" full. The other thicknesses (whether thicker or thinner) are made specially and at an increased cost. The **sash or rabbet** for regular plate glass glazing should be made to accommodate glass full 5/16" thick. It also treats of **Mirrors and Glazing**.
- 1. This Association has a **Bureau of Publicity and Information** "to furnish free of expense to architects, contractors, builders and owners general information relative to Plate Glass Products and the many uses to which they may be put."
- (c) The Building Data League issued (to members) August, 1917, a 6-page "News Letter" containing résumés of articles on:
 - 1. "Glass, Specifications and Tests," Prof. A. Silverman.
 - 2. "Glass, A Series of Notes," E. H. Bostock. These notes were submitted to several glass manufacturers and their criticisms and comments embodied in the article.
 In a later letter the subject of **transmission and diffusion of light** by glass will be discussed.
- (d) See "Civil Engineers' Pocket Book," J. C. Trautwine, 1913, for **cost**, **dimensions**, **expansion**, **friction**, **strength**, and **weight**.
- (e) See Part II of "Building Construction and Superintendence," F. E. Kidder, "Window-Glass and Glazing." Tables and illus.
- (f) See "Kidders' Pocket-Book," 1916, "Window-Glass and Glazing," with tables of cost, pp. 1487-1495.
- (g) In "Handbook for Architects and Builders," by Illinois Society of Architects (12E16), see section on "Glass and Glazing," pp. 353 and 355, treating of **Window**, **Plate**, **Cast or Rolled**, **Wire**, **Ornamental**, **Colored**, and **Prismatic Glass**, and containing details for "art glass" glazing as mentioned under 12F2b.
- (h) "Mechanical Engineers' Handbook," Lionel S. Marks, 1916, on glass, including **window**, **plate**, **skylight**, **pressed**, **prisms**, **quartz** and **wire glass**.
- (j) "The American Civil Engineers' Pocket Book," M. Merriman, 1916, information on glass.
- (k) "Mechanical Engineers' Pocket Book," Wm. Kent, 1916, information on the **weight** of glass, p. 177, and the **strength** of glass.
- (l) "I.C.S. Building Trades' Handbook," pp. 273-275, on "Glass," contains table of **weights and thicknesses** of glass, and illustrations.

- (m) For "Classification, Manufacture and Strength of Glass," see LeFax Data Sheet, 7-213, compiled by C. H. Riggs.
- (n) "The Building Estimator's Reference Book," F. R. Walker, Chapter XVIII on "Glass and Glazing" contains information on How to Estimate the **Quantity of Glass Required** in any Building; **Labor Cost of Glazing**; **Putty Required** for glazing Wood and Steel Sash; **Net Prices**; **Leaded and Art Glass**; **Structural Glass**; and the **Actual Costs of Glazing**. Also contains complete illustrations.
- (o) "The New Building Estimator," William Arthur, contains sections on **Millwork and Glass**.
- (p) "Plate Glass," H. S. Wherett, *Journal of Society of Constructors of Federal Buildings*, March, 1915.
- (q) Read "The Heat Loss from Buildings and How to Reduce It," *Engineering and Contracting*, March 28, 1917. An editorial advocating and describing the **double glazing** of windows.
- (r) "Glass Manufacture," Walter Rosenhain. 264 pp., illus.
- (s) "Distinction in Windows"—Devices for Glazing—The Possibilities for Making the Most of Our Windows, M. H. Northend, *House and Garden*, October, 1914. Illus.
- (t) Navy Department Specifications (3A1a), "Plate Glass and Window Glass," Feb. 1, 1917, No. 59, Gtc.

12F2 Wire Glass, Roof Openings and Vault Lights

- (a) See, also, 12F1a and other references under Glass and Glazing in General.
- (b) In connection with the use of **Wire Glass**, whether for windows or doors in either exterior or interior openings, the **procedure** to be followed is described in 4C3, Standards Adopted, under Vertical Structural Features, with special reference to Underwriters' Laboratories' "Hollow Metallic Window Frames for Wired Glass." Many other references to Wire Glass will be found under this 4C Section.
- (c) The 1915 N.B.F.U. Building Code defines "Wired Glass" thus: "Glass not less than 3/4" thick enclosing a layer of wire fabric reinforcement having a mesh not larger than 7/8" and the size of the wire not smaller than No. 24 B. and S. Gauge." It gives recommendations for the use of wired glass under several instances. See "Wired glass" and "Fire windows."
- (d) See Reports of the Committee on Fire Resistive Construction N.F.P.A. in various Proceedings resulting in "Specifications for Construction of a Standard Building" and others therein described. Also see "Index to Subjects Covered in the Printed Records" under "Wire-Glass" and **Fire Protecting Coverings** for Window and Door Openings."
- (e) The Building Code of the City of New York, 1916, says: "When **wire glass** is required or permitted . . . for fire-doors, fire-shutters, or fire-windows, the **panes shall not exceed** seven hundred and twenty square inches in **area** and shall not be less than 3/4" in **thickness**, and shall be **set** not less than 5/8" in the frame. When the use of glass is permitted in any fire-door or fire-shutter, only wire glass shall be used. For the glazing of fire-window only wire glass shall be used." It also states "All opening protectives required or permitted . . . shall be constructed as prescribed in such rules, consistent with the provisions of this chapter, as may be promulgated by the superintendent of buildings, or in the absence of such rules as specified in the **standard requirements** of the National Board of Fire Underwriters; or they may be constructed in any manner and of any material that will comply with the fire-test hereinafter prescribed."
- (f) The use of **wire glass for stairway** and other **enclosures** will be found illustrated and referred to in many of the publications listed under Exits, Stairways, Fire Escapes, etc. (4E.)
- (g) See, also, Windows, Doors and Metal Trims (11B7).
- (h) See List of Inspected Mechanical Appliances, Underwriters' Laboratories (3A6b) for makes and distinctive characters of meshes of **wired glass**. The following is quoted: "One-quarter inch wired glass manufactured by the following companies is **standard** for protection against moderate exposure when used in sizes not exceeding **720 square inches** and with neither dimension in excess of **48 inches**, and provided with distinctive marking as noted. Wired glass protection is not the equivalent to that furnished by standard fire-doors and shutters except for moderate exposure. Notice is called to the need of using **standard frames and sash and glazing**, and to the necessity for careful **inspection** before acceptance, in order to obtain wired glass of the required thickness."
- (j) See, also, reference, under 11D2, to latest report of Committee on **Roof Openings and Cornices**, 1917 Proceedings N.F.P.A.; section on "Skylights," in 1915 N.B.F.U. Building Code; and, the "Regulations" of the N.B.F.U., as recommended by the N.F.P.A., on "Skylights." (3A320)
- (k) See "Fire Prevention and Fire Protection," J. K. Freitag, 1912, for information and for **illustrations of Wire Glass**, p. 264; and for data on **Prism Glass**, p. 267. See, also, pp. 450-461.

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- (l) For sizes and weight of Skylight Glass, see "Mechanical Engineers' Pocket Book," Wm. Kent, 1916, p. 196.
- (m) The chief information obtainable on "Vault Lights" and other forms of glass construction for sidewalks, roofs, and similar purposes is that issued by the various manufacturers which usually includes details, though not always for the setting, caulking or other manner of making the surrounding joints water-tight. In 12F1a are illustrations and descriptions of Prism Glass and Tiles, Sidewalk Glass, Glass Lenses, Skylight-Floorlight, Description of Installation Conditions.
- (n) For "Prismatic Sidewalk Lights," see "The Building Estimator's Reference Book," F. R. Walker pp. 2901-2903.
- (o) For references in Industrial Section applicable to this division, see:
 1. "Model Specification" for use of "Feralun" set flush in cement of sidewalk Vault Lights, p. 168, American Abrasive Metals Co.

12F3 Leaded and Decorative Glass

- (a) The National Ornamental Glass Manufacturers' Association (12A9), which publishes the "Ornamental Glass Bulletin of the U. S. and Canada," at a meeting June 2, 1914, *Resolved*:
 "That the use of zinc, commonly known as hard metal, for the use of glazing church windows shall be discouraged on the ground that it is impractical and not a proper material to use in exterior glazing as a substitute for lead (for four reasons which are amplified)."
- (b) See details approved and recommended by the above Association as the minimum size of rabbets, jambs and sills for art glass glazing; also details for metal sash and ventilator construction in "Handbook of Illinois Society of Architects," 1917.
- (c) The following are a few of the special references which might be given; others will be found under 12E and 12F1, including "Suggestions and Practical Points" and "colored glass," cathedral glass, etc., in 12F1a:
- (d) "Vitrail (Stained Glass)," par Mons. Viollet le Duc, translated by Leicester B. Holland, *Architectural Record*, December, 1912, p. 487. Illus. English translation from the "Dictionnaire Raisonné De L'Architecture Française" by M. Viollet-le-duc. This is the first of a series of four articles comprising the entire treatise.
- (e) "Decorative Glass Processes," Arthur Louis Duthie. 279 pp.
- (f) "The Art of Making a Stained Glass Window," with notes on the Work of C. M. Burd, by C. H. Dorr, *Architectural Record*, February, 1914, p. 163. Illus.
- (g) "The Development of Art Glass Windows" in *The Painter and Decorator*, October, 1917, by Col. Livermore, from "Ornamental Glass Bulletin."
- (h) "Treatise on the Art of Glass Painting," E. R. Suffling. 150 pp.
- (j) See especially the chapter on "Decorative and Stained Glass" in the book, "Church Buildings," by Ralph Adams Cram.
- (k) "Stained Glass Work, a Text Book for Students and Workers in Glass," by C. W. Whall, with designs and complete illustrations pertaining to the craftsmanship. Artistic Crafts Series of technical handbooks, edited by W. R. Lethaby. 1905. 380 pp.
- (l) "Stained Glass of the Middle Ages in England and France," by Lawrence B. Saint and Hugh Arnold. 270 pp. Colored illus.
- (m) "Windows, a book about Stained and Painted Glass," by Lewis F. Day. 1909. 420 pp. Illus.

12F4 Store-Front Construction and Store Fittings

The chief literature concerning latest developments in the metal and glass construction of store and shop windows is put forth by the manufacturers of either the metal or the glass, frequently by the two together. These publications generally give details for the setting of the frames as well as of the glass, which provide for ventilating, condensation and other essential features.

See some of the references given under Glass and Glazing in General, particularly 12F1a and c.

- (a) See Part II of "Building Construction and Superintendence," F. E. Kidder, for early and modern forms and methods of "Store-Front Construction," pp. 221-229, showing plans, details, and sections. See, also, *Specifications for Store-Front Construction*, pp. 790 and 791.
- (b) "English Shop-Fronts, Old and New," Horace Dan and E. C. M. Willmott. A series of examples by leading architects, selected and specially photographed, together with descriptive notes and illustrations.
- (c) "Store-Fronts and Interior Details," W. T. Comstock, gives designs, plans, and details for small stores; also designs for special fronts for restaurants, cafés, banks, etc.
- (d) "Store Fittings," W. T. Comstock, counter and showcase, wall-shelving, telephone-case, etc., with details.
- (e) For detailed drawings of *Bronze Store-Front Construction*, see Industrial Section, p. 209, The Gorham Co.

12F5 Glassware and Glass Products

- (a) For information on, and illustrations of, glassware for use in connection with lighting fixtures, see references under "Lighting Fixtures" (11B13).
- (b) See "Illustrations of Electrical Fixtures and Equipment," pp. 93-133 (includes glassware for inside and outside use) in "General Electrical Specifications No. 6, Prepared in the Office of the Quartermaster General, U. S. Army, March, 1915." (9M1).
- (c) For brief information on Glass Tile, see section on "Memoranda on Tiling" in "Kidders' Pocket Book," 1916, p. 1520.
- (d) See "I.C.S. Building Trades' Handbook," for brief information on glass tile, p. 317.
- (e) "American Glassware, Old and New," A Sketch of the Glass Industry in the U. S., and Manual for Collectors, E. A. Barber.
- (f) "The Art of Repairing and Riveting Glass, China and Earthenware," J. Howorth. 23 pp., illus.
- (g) "Recipes for Flint Glass Making," D. Van Nostrand Company.

12F6 Greenhouses, Landscape Design, Garden Accessories

With respect to the construction of greenhouses, the details and literature obtainable from the makers is the chief source of information to be had.

- (a) For publications of interest in connection with this section, obtain from Superintendent of Documents, Washington, D.C., list of publications issued by the Department of Agriculture, Bureau of Plant Industry, Federal Horticultural Board, and Forest Service; also of the Department of the Interior, National Park Service, and Reclamation Service (for reference to the latter, see 9D3). Also of Bureau of Education (12G1) for School Gardens, etc.
- (b) "Greenhouse Construction," L. R. Taft. 210 pp., illus.
- (c) "Greenhouse Management for Amateurs," W. J. May. Illus.
- (d) "Greenhouse Construction and Heating," B. C. Ravenscroft. Illus.
- (e) See "Mechanical Engineers' Pocket Book," Wm. Kent, 1916, for information on heating greenhouses by steam and hot-water.
- (f) "America First in Conservatories," The Possibilities of Plant-growing under Glass the Year Around—Tropical Gardens for Northern Winters, R. Dixon, *House and Garden*, January, 1917.
- (g) "Does the Small Greenhouse Pay?" Yes. . . . The Vital Questions of Cost and Yield, F. F. Rockwell, *House and Garden*, November, 1917. Illus.
- (h) "Plants That Live in Glass Houses," W. C. McCollom, in *The Independent*, Nov. 3, 1917. Describes procedures, illustrates greenhouses, and gives cross sections showing details of construction.
- (j) For numerous valuable articles on the relation of landscape design to architectural practice and for descriptions of outdoor theatres, skating-rinks, balustrades, steps, approaches, pools, fountains, garden-houses and garden accessories, see *Landscape Architecture*, a quarterly magazine published by Lay, Hubbard & Wheelwright, 15 E. 40th Street, New York City. Also important reviews of books on landscape matters.
- (k) See "Garden Craft in Europe," by H. Inigo Triggs. Contains historical data, numerous illustrations, and a bibliography. 1913. 332 pp.
- (l) See "Gardens for Small Country Houses," by Gertrude Jekyll and Lawrence Weaver. Valuable articles on garden design and accessories from *English Country Life*. 260 pp. Completely illus.
- (m) See "The Planning and Planting of Golf-Courses," F. N. Evans, in *Landscape Architecture*, 1917. Illus.
- (n) "Outdoor Theatres; The Design, Construction, and Use of Open-Air Auditoriums," R. G. Badger, Boston. 1917. 151 pp., illus. A collection of examples, many in the United States.
- (o) "American Gardens," edited by Guy Lowell. 240 pp., illus.
- (p) See "City Planning Progress in the U. S.," 1917, American Institute of Architects, and sections on Town Planning and Housing in *The Journal of the American Institute of Architects* for review of subjects of allied interest.
- (q) "A classified List of References on City Planning" (50 cts.), prepared by T. Kimball, Librarian of the School of Landscape Architecture, Harvard University, is issued by the National Conference on City Planning, now the American City Planning Institute, which also publishes *The City Plan*, its official organ, quarterly, and issues many other publications as of interest here.
- (r) A bibliography of recent publications of interest to landscape architects (compiled by Harvard University, School of Landscape Architecture) was published in *Landscape Architecture* (quarterly); 1917.
- (s) "Popular Education in Architecture and Landscaping," A Summary of The Work of Federal and State Agencies, C. F. Pilat, *Architectural Record*, June, 1917, p. 542.
- (t) "Landscape Architecture," George Burnap, *The American Architect*, January, 1914, Illus.

- (u) See "Gardens Old and New," 4 vols., edited by H. Avray Tipping and Chas. Latham. Profusely illustrated articles from *English Country Life*.
- (v) See, also, series of books on garden design by Gertrude Jekyll published by *English Country Life*.

- (w) "The Final Touch to the Landscape Scheme," is supplied by the *Water Feature*, be it Pool or Fountain, Stream or Lake—Suggestions for Planning, Construction and Care, R. S. Lemmon, *House and Garden*, June, 1917. Illus.

12C Schoolhouses, Grounds and Equipment

12C1 U. S. Bureau of Education, Department of the Interior

Commissioner: Philander P. Claxton, Washington, D. C.

Anyone interested in the **planning and designing of schoolhouses** and in the development of general educational matters, including **vocational training and civic education**, should not fail to send for and read the latest "Statement of the Commissioner of Education to the Secretary of the Interior" and to secure "Available Publications of the U. S. Bureau of Education, July, 1917." Some of these are still in stock for free distribution, others may be obtained from the Superintendent of Documents at the price stated. The Bureau serves as a clearing-house for accurate and comprehensive information in respect to all educational agencies and all forms of education in the U. S. and all foreign countries, and to disseminate this information among school officers, teachers, students of education, and all others directly interested in any form of educational activity. It also undertakes, after correspondence and personal conference, to formulate the consensus of expert opinion.

It makes or directs surveys of state, county and city school systems, of individual schools or groups of schools, and reports its findings, together with constructive suggestions, to the proper officials. It works out plans for promoting education in agriculture, trades, and industries; for home-making and for the consolidation of rural schools; for making homes for teachers and school-farms part of the equipment for rural schools; for bringing the school and the home closer together; and for everything which makes for better schoolhouses and the care of the health of school-children.

A special agent of the Bureau located at Nashville, Tenn., has, on request, given specific advice to school authorities in regard to the **architecture of school-buildings** and the **hygiene and sanitation of schoolhouses and grounds**, particularly in rural communities. He has had charge of the **models of rural schoolhouses** which the Bureau has been lending to communities about to erect new buildings, and has distributed them among school officers where they could be utilized to the greatest advantage in guiding and developing a taste for a better type of rural school architecture. Counties in several states have taken these models as **standards** and are working out better school-buildings for their rural districts.

In cooperation with S. C. Kingsley of the Elizabeth McCormack Memorial Fund of Chicago, this special agent has prepared a bulletin on **open-air schools** (1916, No. 23), and in cooperation with Miss H. Le Garde, of Providence, he is preparing a bulletin on **school-baths**. He has also completed a bulletin on **schoolhouse architecture**, which is supplementary to a comprehensive bulletin which he prepared for this Bureau in 1910, and which has been of very definite value to school boards and school architects in this and other countries. The Bureau has on file approximately 1,000 **bibliographies** on various subjects of **education and school administration** which will be sent to those making special request. The Bureau carries on an extensive correspondence and will place upon its **mailing-list** the names of those who desire to be notified when publications **relating to school architecture** are issued.

Among these publications are:

- (a) "**American Schoolhouses**," F. B. Dresslar, Professor of Philosophy and Education in the University of Nebraska, Bulletin No. 5, 1910 (75 cents), contains 106 pp. of text relating to every consideration, from the selection of architect and site to all phases of the subject, including lighting, stairways, and complete equipment. Illustrated with 267 plates, including "**Standard Designs**" of states. Contains also an appendix in which is given "**References on School Architecture and Sanitation**" (to that date).
 - (b) "**Rural Schoolhouses and Grounds**" by same author as (a), Bulletin No. 12, 1914, 162 pp. of text completely treating the subject, including collateral **sanitary features** and 44 plates, among which are included illustrations of some of the **models** referred to in the foregoing description of the Bureau.
 - (c) "**Sanitary Schoolhouses**," Bulletin No. 52, 1913, legal requirements in Indiana and Ohio. 5 cents.
2. See the reference under 5G1a to "**The One-Story Schoolhouse Idea**" issued November, 1917, by the National Lumber Manufacturers' Association, prepared in cooperation with the U. S. Bureau of Education. See, also, "**Teachers Cottages**," 5G2c.
 3. For the many other references which have been made throughout the year to various features of schoolhouse construction, particularly in Serials Nos. 4 and 5, see the Index to Vol. I of the Structural Service Book.

4. Many states have "**School Codes**," some provisions of which relate to area of rooms, area of light, ventilation, fire-resistant construction, exits, and other important structural features. The Division of School Administration of the U. S. Bureau of Education compiled a **digest of the general school laws** of all the states which has been published as Bulletin No. 47, 1915.
5. The **Carnegie Foundation for the Advancement of Teaching** in its 1916 Report covers studies undertaken in Agricultural Education and Engineering Education but apparently nothing of structural significance.
6. The **National Educational Association** has a **Committee on Standardization of Schoolhouse Planning and Construction**, of which F. Irving Cooper, Architect, Boston, is Chairman. The work of this Committee is not intended to hamper or bind freedom of design by architects but to present to the Association certain definite standards in connection with details of construction and in minimum requirements of space for stated school activities.
7. **Accounts of investigations** undertaken and various **results accomplished** along the above lines, and other matters of interest, will be found with frequency in *The American School Board Journal* whose cooperation with the Institute in matters of public information has heretofore been acknowledged.
8. The **American School Hygiene Association** in Proceedings of Fifth Congress publishes "**Schoolhouses and the Law**," an address by F. I. Cooper, containing a chart and digests giving status of compulsory regulation of schoolhouse construction in the U. S. (to 1910).
9. See "**Building Code**" recommended by the N.B.F.U., 1915. States when schools may be non-fireproof, p. 20; when doors should open inward, p. 56; describes and illustrates **stairs and stairways**, **smokeproof towers** and other means of egress, and gives the height of stairway risers in primary schools, pp. 55-77.
10. See other references under **Exits, Stairways and Fire Escapes**, etc., 4E.
11. Chapter XXIII on "Schools," in "Fire Prevention and Fire Protection," by J. K. Freitag, 1912, pp. 740-756, treats of fire-resistant construction and contains plans and tables.
12. "**School Architecture**," Edmund M. Wheelwright. Illus.
13. See "The Schoolhouse Department of Boston, Mass., viewed as a method of relieving boards of education or school committees of the direct responsibility for the purchase of land and erection of buildings," R. Clipston Sturgis, formerly chairman Boston Board of Schoolhouse Commissioners, in *School Board Journal*, 1913.
See, also, **Annual Reports** of the Schoolhouse Department, City of Boston.
14. See "**The Cost of School Buildings**" by William B. Ittner, formerly Architect to the Board of Education, St. Louis, in *School Board Journal*, August, 1915.
15. "**American School Building Standards**," Wilbur T. Mills. 225 pp., illus.
16. "**Modern Schoolhouses**," A. D. F. Hamlin and C. B. J. Snyder.
17. See Bruce's School Architecture Library, prepared under the direction of Wm. C. Bruce, Editor *American School Board Journal*.
(a) "**High School Buildings**," 200 pp., illus.
(b) "**Grade School Buildings**," 256 pp., illus.
18. "**School Architecture**," Wm. Geo. Bruce, assisted by W. C. and F. M. Bruce.
19. "**Mechanical Equipment of School Buildings**," Harold M. Alt. 112 pp., illus.
20. "**Modern School Building**," Wm. T. Comstock.
21. "**Modern School Buildings—Elementary and Secondary**," Felix Clay. Illus.
22. "**Modern American School Buildings**," Warren R. Briggs. 411 pp., illus.
23. "I.C.S. Building Trades' Handbook," contains a section on "**Schoolroom Data**," pp. 397, 398.
24. "**For Fireproof Schools**," *The American Architect*, February, 1914.
25. See "The American Civil Engineers' Pocket Book," M. Merriman, 1916, for information on **floor loads for schools**, pp. 715 and 722.
26. "**The Ventilation of the Schoolroom**," Wm. J. Baldwin. 46 pp., illus.
27. See "**High School Planning**," Dwight H. Perkins, *School Board Journal*, for Oct., 1917. Plans and illustrations of four buildings.

STRUCTURAL SERVICE BOOK

28. Also "Relations between Boards of Education, their Superintendents and the Architect," John J. Donovan, A.I.A., *School Board Journal*, November, 1917.
29. "The School Building as a Neighborhood Center," R. Weintrob, *School Board Journal*, December, 1917.
30. See "Social Center Features" in New Elementary School Architecture and the Plans of Sixteen Socialized Schools," C. A. Perry. 55 pages of text and other illustrations. Published by the Division of Recreation, Russel Sage Foundation, 1912. 25 cts.
31. The Department of Child Hygiene, Russell Sage Foundation, publishes many pamphlets, among them (full list upon application to 12L7):
- (a) *Vacation Schools*. 32 pp. Illus. and Bibliography. 5 cts.

- (b) *Evening Recreation Centers*. 32 pp. Short Bibliography. 5 cts.
- (c) *The Community-Used School*. 9 pp. 5 cts.
32. See "Wider Use of the School Plant," C. A. Perry, Department of Child Hygiene, R. S. F. 404 pp., illus.
33. "Among School Gardens," M. L. Greene. 380 pp., illus.
34. The American Institute of Architects has a Committee on School Building Measurements, Wm. H. Brainerd, Chairman, the reports of which are awaited with interest.
35. The National Association of School Accountants has a committee which has reported on the classification of school buildings, of construction and division of cost.
36. See *Standard Requirements in Regard to Plans and Specifications of Minnesota School Buildings*, by S. A. Challnan, The Improvement Bulletin, Dec. 29, 1917.

12H Farm Buildings, Accessories and Rural Engineering

12H1 Department of Agriculture, U. S. A.

- (a) Office of Public Roads and Rural Engineering.
(b) Bureau of Animal Industry.
(c) Bureau of Plant Industry.
(d) Weather Bureau.
(e) Forest Service, described under 5A1.
(f) Federal Horticultural Board, referred to under 12F6a).

The activities of the Department of Agriculture, which are of interest to those concerned in structures, their equipment and accessories, are confined to subjects bearing upon agriculture and are centered chiefly in the Division of Rural Engineering of the Office of Public Roads and Rural Engineering, although information relating to structures of various kinds and their equipment may be found in publications emanating from other Bureaus.

With regard to structural matters, the public service of the Office of Public Roads and Rural Engineering consists of the preparation of designs for all kinds of **farm structures and equipment**, the planning of **farmsteads**, and the designing of **farm water-supply and sewage-disposal systems**.

Upon request, accompanied by a statement of the requirements or conditions to be met, a selection of the available designs which most nearly meet the conditions are issued without charge. Advice is given on all matters relating to these subjects.

There are a number of publications issued by the Department of Agriculture which bear directly or indirectly on subjects pertaining to **agricultural construction**. The Division of Publications of the Department of Agriculture publishes a list of the Bulletins, etc., issued since July, 1913. Some of these publications are available for free distribution, while others, so designated, may be had only from the Superintendent of Documents, Government Printing Office, for the prices stated. This list is revised once a year and is mailed upon request.

The Division of Publications also issues a **monthly list of new publications** which is sent regularly to those making application for it. Reference to reports of the Weather Bureau of interest to architects, heating contractors, and owners was made under 10C14.

The Superintendent of Documents, Government Printing Office, publishes a price-list of the Department of Agriculture publications, that is, *Farmers' Bulletins*, *Department Bulletins*, and *Yearbook Separates*. This list is available upon request, and the following is a selection applicable to this section:

Bureau of Animal Industry:

- Circular No. 131—Designs for **Dairy Buildings**. 5 cts.
Circular No. 136—How to Build a **Stave Silo**. 5 cts.
Circular No. 173—The Sanitary Construction and Equipment of **Abattoirs and Packing-Houses**. 5 cts.
Circular No. 195—A Plan for a **Small Dairy-House**.

Farmers' Bulletins: (Price, from Superintendent of Documents, is 5 cents each.)

- No. 32—**Silos and Silage**. Chas. S. Plumb. 1895.
No. 40—**Farm Buildings**. E. G. Elliott. 1896.
No. 43—**Sewage-Disposal on the Farm and Protection of Drinking-Water**. T. Smith. 1896.
No. 126—**Practical Suggestions for Farm Buildings**. Geo. G. Hill.
No. 138—**Irrigation in Field and Garden**. E. J. Wickson. 1901.
No. 150—**Clearing New Land**. F. Williams. 1902.
No. 187—**Drainage of Farm Lands**. E. G. Elliott. 1904.
No. 235—**Cement Mortar and Concrete**. P. L. Worsey. 1905.
No. 239—**The Corrosion of Fence Wire**. A. S. Cushman. 1905.
No. 270—**Modern Conveniences for the Farm Home**. E. T. Wilson. 1906.

- No. 338—**Macadam Roads**. A. B. Fletcher. 1908.
No. 367—**Lightning and Lightning Conductors**. A. J. Henry.
No. 403—**The Construction of Concrete Fence-Posts**. 1910.
No. 458—**Hog-Houses**. J. A. Warren. 1911.
No. 461—**The Use of Concrete on the Farm**. 1911.
No. 463—**The Sanitary Privy**. C. W. Stiles and L. L. Lunsdem. 1911.
No. 474—**The Use of Paint on the Farm**. P. H. Walker. 1911.
No. 475—**Ice-Houses**. L. B. Corbett. 1911.
No. 481—**Concrete Construction on the Live-Stock Farm**.
No. 524—**Tile Drainage on the Farm**. A. G. Smith. 1913.
No. 574—**Poultry-House Construction**. A. H. Lee. 1914.
No. 623—**Ice-Houses and the Use of Ice on the Dairy Farm**. J. T. Bowen and G. H. Lambert. 1915.
No. 628—**A Simple Trap-Nest for Poultry**. A. R. Lee. 1915.
No. 689—**A Plan for a Small Dairy-House**. E. Kelly and E. E. Parks. 1915.
No. 744—**The Preservation Treatment of Farm Timbers**. G. M. Hunt. 1916.
No. 786—**The Windbreak as a Farm Asset**. C. G. Bates. 1917.
No. 810—**Equipment for Farm Sheep-Raising**. V. O. McWhorter. 1917.
No. 825—**Pit Silos**. T. P. Metcalf and G. A. Scott. 1917.
No. 828—**Farm Reservoirs**. Samuel Fortier. 1917.
No. 842—**Modern Methods of Protection Against Lightning**.

Department Bulletins:

- No. 57—**Water-Supply, Plumbing and Sewage-Disposal for Country Homes**. R. W. Trullinger, Office of Experiment Stations. 1914. 10 cents.
No. 230—**Oil-Mixed Portland Cement Concrete**. 1915. 10 cents.
No. 277—**Cotton Warehouse Construction**. R. L. Nixon. 1915. 10 cents.
No. 552—**The Seasoning of Wood (Professional Paper)**. H. S. Betts. 1917.

Yearbook Separates:

- No. 634—Y. B. 1914. **Clean Water and How to Get It on the Farm**. 10 cents.
No. 712—Y. B. 1916. **Sewage-Disposal on the Farm**. 5 cents.

2 Other References:

- (a) See **General Index**, under the name of the building desired, for references made throughout this book to types of rural buildings in other than the governmental publications above noted. These appear chiefly in Serial Nos. 1, 3, 4, 5 and 11, notably the ten "**Rural Architecture**" Bulletins of the National Lumber Manufacturers' Association described under 5G2c5, the several publications of the Portland Cement Association devoted to **Agricultural Buildings and accessories**, listed under 11D4a and others separately indexed.
- (b) Articles and illustrations featuring all kinds of Farm Buildings will be found in the Cement and other technical publications and in much of the literature of manufacturers of cement, hollow-tile, brick, lumber, and other building materials.
- (c) See, also, "Modern Farm Buildings" by Alfred Hopkins, Architect. Important plans, illustrations and details, of barns and other farm buildings, dairies, poultry-houses, etc. 1913. 206 pp.
- (d) As a result of competitions held by the Minnesota State Art Commission, plans and illustrations of eighteen "model farm-houses," in folio form, may be obtained from the Commission for \$1.75. A folio of eighteen "small homes" may also be had for \$2. A booklet, "Your Home," will be sent by the Commission for 4 cents in stamps.

12J Workmen's Houses, Workmen, Industry, Safety to Life

1 Bureau of Labor Statistics, U. S. Department of Labor:

Commissioner: Royal Meeker, Mills Building, Washington, D. C.

The Bureau of Labor Statistics collects and collates statistics of the conditions of labor and distribution of the products of labor, and the

Secretary of the Department of Labor publishes such statistical information in his **Annual Report**.

It issues, "**Monthly Review of the U. S. Bureau of Labor Statistics**" and also publishes, from time to time, **Bulletins**. No charge is made for any Department's publications in stock.

The Bureau of Labor Statistics has recently conducted a study of housing conditions in the U. S. A full report is now being prepared for publication, and an article in summarization and anticipation of this report appeared in the November issue of the *Monthly Review*, in which also will be found "Employers' Housing in the U. S.," by Leifur Magnusson, describing company towns and houses, with illustrations and plans of typical company houses in various towns.

In the January, 1917, *Monthly Review* will be found "Some Recent Housing Literature," and an account of the discussion on Industrial Housing at the 12th Annual Convention of the American Civic Association.

(a) In September, 1904, the Bureau of Labor, then a part of the Department of Commerce and Labor, issued Bulletin No. 54 (1490 pages, 266 plates), describing the housing of working people and giving statistics on labor, descriptions of public baths in the U. S., trade and technical education, with plans and illustrations of employees' homes.

(b) The Department of Labor issued Bulletin Whole No. 158, Miscellaneous Series No. 5, 1915, entitled "Government Aid to House Owning and Housing of Working People in Foreign Countries," 450 pp.

2 The U. S. Bureau of Mines (2A3) has issued:

(a) Bulletin No. 87: "Houses for Mining Towns," described under 9Lie.

(b) Technical Paper No. 116: "Miners' Wash and Change Houses," described under 9J1b.

3 The Journal of the A.I.A., October, 1917, contains a bibliography or selected list of references on industrial housing, and in that and other recent issues of the Journal appear what are perhaps the most important contributions to this subject now to be found.

In the bibliography are listed specific articles and books as well as proceedings and other publications of the several foreign and American Associations which hold conferences and other meetings at which papers are presented and discussed. These include the National Housing Association, the American City Planning Institute, The American Academy of Political and Social Science and others which are referred to in this book. Consult the lists issued by each. See, also, Bulletins of the American Iron and Steel Institute (1F2a).

4 National Association of Real Estate Boards

Secretary: Tom. Ingersoll, Minneapolis, Minn.

At a meeting of the Housing Committee it was: "Resolved, That we, the Executive Committee of the National Association of Real Estate Boards, in regular meeting assembled, in the city of Indianapolis, Ind., on Oct. 23, 1917, approve of the Government of the United States financing the building of workingmen's homes as a war-measure in munition centers, provided such homes are built in a substantial manner."

5 The International Association of Industrial Accident Boards

Sec.-Treas.: Royal Meeker, Mills Building, Washington, D. C.

This Association, the U. S. Department of Labor, the various state labor agencies, the American Federation of Labor, and the seven next named bodies are concerned with the subject of accident prevention, safety to life, and improvement of conditions in the building trades. Their activities will be recorded in subsequent issues.

6 American Museum of Safety

Secretary: Wm. J. Moran, 14-18 W. 24th Street, New York City.

7 National Safety Council

Secretary: W. H. Cameron, Continental and Commercial Bank Bldg., Chicago, Ill.

12 American Society of Safety Engineers

Secretary: W. John Pedroncelli, 30 E. 42d Street, New York City.

8 National Association of Manufacturers of the United States of America

Secretary: G. S. Boudinot, 30 Church Street, New York City.

9 The National Association of Builders' Exchanges, of the United States of America

Secretary: E. M. Tate, Fulton Building, Pittsburgh, Pa.

Sixty-three Builders' Exchanges in various cities throughout the country, some of which issue Bulletins and similar publications, are affiliated with the National Association.

This Association is one of those which has greatly assisted the Institute in the preparation of "The Standard Documents," briefly referred to under 1A8g and described in the Journal for January, 1918.

10 The Master Builders' Association, of Boston

Secretary: W. H. Sayward, 166 Devonshire Street, Boston.

Issues "Monthly Letter" to members and others interested.

11 American Federation of Labor (Building Trades Department)

Secretary: Wm. J. Spencer, A. F. of L. Building, Washington, D. C.

The entire resources of the Department have been placed at the disposal of the Council of National Defense in connection with the war program of the Government, in the belief that a recognition of workmen's rights and standards should be maintained in order that normal conditions may prevail in the building industry when the war is over. In various states there exist building trades councils, and the following is a list of the affiliated Internationals which comprise the Building Trades Department:

(a) International Association of Heat and Frost Insulators, and Asbestos Workers: Sec'y: T. J. McNamara, 4833a Natural Bridge Avenue. St. Louis, Mo.

(b) Bricklayers, Masons and Plasterers' International Union. Sec'y: Wm. Dobson, University Park Bldg., Indianapolis.

(c) International Association of Bridge and Structural Iron Workers. Sec'y: Harry Jones, 422 American Central Life Bldg., Indianapolis, Ind.

(d) United Brotherhood of Carpenters and Joiners. Sec'y: Frank Duffy, Carpenters Bldg., Indianapolis, Ind.

(e) International Brotherhood of Electrical Workers. Sec'y: C. P. Ford, Reisch Bldg., Springfield, Ill.

(f) International Union of Elevator Constructors. Sec'y: F. J. Schneider, Perry Bldg., Philadelphia, Pa.

(g) International Union of Steam Engineers. Sec'y: J. G. Hannah, 6334 Yale Ave., Chicago, Ill.

(h) Granite Cutters' International Association of America. Pres.: James Duncan, Hancock Bldg., Quincy, Mass.

(j) International Hod Carriers, Building and Common Laborers' Union. Sec'y: A. Persion, 82 State St., Albany, N. Y.

(k) International Union of Wood, Wire and Metal Lathers. Sec'y: R. V. Brandt, Superior Bldg., Cleveland, Ohio.

(l) International Association of Marble and Stone Polishers, Rubbers and Sawyers. Pres.: S. C. Hogan, 406 E. 149th St., New York City.

(m) International Alliance, Amalgamated Sheet Metal Workers. Sec'y: J. E. Bray, Nelson Bldg., Kansas City, Mo.

(n) Brotherhood of Painters, Decorators, and Paperhangers. Sec'y: J. C. Skemp, Drawer 99, Lafayette, Ind.

(o) Plasterers' Operative and Cement Finishers' International Association. Sec'y: T. A. Scully, Castell Bldg., Middletown, Ohio.

(p) United Association of Plumbers and Steam Fitters. Sec'y: T. E. Burke, 411 Bush Temple of Music, Chicago, Ill.

(q) International Brotherhood of Composition Roofers, Damp- and Waterproof Workers of United States and Canada. Sec'y: D. J. Ganley, 14 N. Oxford St., Brooklyn, N. Y.

(r) International Union Slate and Tile Roofers. Sec'y: J. M. Gavlak, 3643 W. 47th St., Cleveland, Ohio.

(s) Journeymen Stone Cutters' Association of North America. Sec'y: W. W. Drayer, Central Life Bldg., Indianapolis, Ind.

(t) Ceramic, Mosaic and Encaustic Tile Layers' and Helpers' International Union. Sec'y: J. P. Reynolds, Martin Bldg., North Side, Pittsburgh, Pa.

13. For references in Industrial Section applicable to this division, see:

(a) Assurance of Safety to Life, National Automatic Sprinkler Association, pp. 180-183.

12K Acoustics and Sound-Transmission Prevention

It had been the intention to publish a list of references on this important subject, but the collection has increased to such an extent that it is impossible to give space here for a proper listing. The S.S.D. possesses a complete list of references, beginning with discussions in the 16th Congress of the U. S., 1821, and the 21st Congress, 1830, taken part in by Charles Bulfinch and Wm. Strickland, Architects, down to the present writings of Wallace C. Sabine, W. R. C. Rowan, Alexander Cooper, Serial No. 12

and others, copy of which list will be furnished upon request to the Journal.

See 11D6 (cc), (dd), and (ee) for brief references.

For references in Industrial Section to the subject of Acoustics, see:

1. Acoustile, The Perfector of Acoustics, Mazer Acoustile Company, p. 169.

12L Other Organized Bodies

- 1 *American City Planning Institute*, formerly the *National Conference on City Planning*.
Secretary: Flavel Shurtleff, 10 Congress Street, Boston.
 At the first meeting of the new Institute in New York City, Nov. 24, 1917, the President was authorized to appoint a committee to consider the feasibility of proposing **principles** which should be **incorporated** in all **districting** or **zoning regulations**.
 In the 1915 Proceedings will be found the results of a start made to determine the **standard size of lot and block**, and in "*The City Plan*" for October, 1915, these are summarized by E. P. Goodrich, "Best Methods of Land Subdivision," and P. A. Harsch, "Land Subdivision, The Point of View of the Real Estate Developer."
 Other references to its publications under 12F6q.
- 2 *Chamber of Commerce of the United States of America*
Secretary: Elliot H. Goodwin, Riggs Building, Washington, D. C.
 "**The Nation's Business**" is published by the Chamber of Commerce of the United States "to furnish executive officers of business corporations with authoritative information regarding all events and tendencies in business and government that are of fundamental importance."
 A call has been issued by the Chamber of Commerce of the United States for a meeting in Washington, December 12, of the chairmen of war-service committees, representative of **every industry** in the country, primarily to perfect plans for **co-operation** with the **Government**. This will develop discussion of the **readjustment** of industries to meet war demands.
- 3 *The National Association of Purchasing Agents*
Secretary: L. F. Boffey, 25 Beaver Street, New York City.
 This Association advocates, and is working for, a **standard size of catalog**. It recommends the adoption of letterhead size, $8\frac{1}{2} \times 11$, for all catalogs or other advertising literature designed for **filing purposes**.
 This action is in consonance with that of the American Institute of Architects which adopted this size as **Standard** and issues a "Circular as to **Size and Character of Printed Matter** intended for Architects Files" (1A8b).
- 4 *United Engineering Society*
Secretary: Calvin W. Rice, 29 W. 39th Street, New York City.
 Formed in 1904 to advance the engineering arts and sciences in all their branches, and to maintain a **free public engineering library**. Issues no publications and is not to be confused with the Association of Engineering Societies which formerly existed for the purpose of publishing a coöperative journal containing papers read before the member societies, frequent reference to which Journal will be found in the S.S.D.
- 5 *American Association for the Advancement of Science*
Secretary: L. O. Howard, Smithsonian Institute, Washington, D. C.
- 6 *The Rockefeller Foundation*
Secretary: Edwin R. Embree, 61 Broadway, New York City.
- 7 *Russell Sage Foundation*
 1 Madison Avenue, New York City.
 See references to Division of Recreation and Department of Child Hygiene, 12G1, 30b and 31.
- 8 *The American Hospital Association*
Secretary: William H. Walsh, 728 Seventh Street, N. W., Washington, D. C.
- 9 *American Association of Engineers*
Secretary: Arthur Kneisel, 29 S. La Salle Street, Chicago, Ill.
- 10 *The Municipal Engineers of the City of New York*
Secretary: George A. Taber, 29 W. 39th Street, New York City.
- 11 *Society for the Promotion of Engineering Education*
Secretary: F. L. Bishop, Pittsburgh, Pa.
- 12 *American Society of Engineering Contractors, Inc.*
Secretary: J. R. Wemlinger, 44 Whitehall Street, New York City.
- 13 *General Contractors' Association*
Secretary: C. A. Crane, 51 Chambers Street, New York City.
- 14 *National Erectors' Association*
Secretary: C. E. Cheney, 286 Fifth Avenue, New York City.
 Other associations, not previously mentioned, which are interested in various phases of structural activities, are:
- 15 *Factory Insurance Association*
Manager: H. L. Phillips, 266 Pearl Street, Hartford, Conn.
- 16 *International Association of Municipal Electricians*
Secretary: C. R. George, Houston, Tex.
- 17 *Mutual Fire Prevention Bureau*
Secretary: William Reed, Oxford, Mich.
- 18 *National Association of Insurance Commissioners*
Secretary: Fitzhugh McMaster, Columbia, S. C.
- 19 *The Union*
 Insurance Exchange, Jackson Street, Chicago, Ill.
- 20 *Society Advocating Fire Elimination*
Secretary: Ralph P. Stoddard, 356 Leader News Bldg., Cleveland Ohio.
- 21 *Western Association of Electrical Inspectors*
Secretary: W. S. Boyd, 175 Jackson Building, Chicago, Ill.
- 22 *The Elevator Manufacturers' Association of the U. S.*
Secretary: I. N. Haughton, Haughton Elevator Co., Toledo, Ohio
 Adopted October 12, 1917, "**Uniform Regulations for the Construction and Installation of Passenger and Freight Elevators.**" This consists of **Definitions, Regulations** applying to New Elevator **Installations, Shaftways**, being 40 pages of specifications in detail as to all regulations and accessorial requirements.
- 23 *National Building Granite Quarries Association, Inc.*
Field Secretary: John S. McDaniel, 31 State Street, Boston, Mass.
- 24 *National Housing Association*
Secretary: Lawrence Veiller, 105 E. 22d Street, New York City.
- 25 *American Civic Association*
President: J. Horace McFarland, Harrisburg, Pa.
- 26 *American Society of Landscape Architects*
Secretary: Alling S. DeForest, 222 Sibley Block, Rochester, N. Y.
- 27 *The American Scenic and Historic Preservation Society*
- 28 *American Road Builders' Association*
Secretary: E. L. Powers, 150 Nassau Street, New York City.
- 29 *American Highway Association*
 (Dissolved in 1917.)
- 30 *National Association of Mixer Manufacturers*
Secretary: Harold E. Smith, 1125 32d Street, Milwaukee, Wis.
 There is also record of:
- 31 *American Academy of Political and Social Science*
Secretary: J. P. Lichtenberger, University of Pennsylvania, Philadelphia, Pa.
- 32 *National Association of Building Owners and Managers*
 Park Building, Pittsburgh, Pa.
- 33 *Building Construction Employers' Association*
Secretary: E. M. Craig, Chicago, Ill.
- 34 *National Builders' Supply Association*
Secretary: L. F. Desmond, 1211 Chamber of Commerce, Chicago
- 35 *National Association of Insurance Agents*
 55 Kilby Street, Boston, Mass.
- 36 *National Association of Credit Men*
 41 Park Row, New York City.
- 37 *Association of Superintendents of Bridges and Buildings*
Secretary: C. A. Lichty, Care of C. & N. W. Railway, Chicago, Ill
- 38 *American Railway Bridge and Building Association*
- 39 *Association of Government Contractors*

Industrial Section

of the

Structural Service Book

Alphabetical List of Producers, Manufacturers, and Organizations Represented in the Industrial Section

*For the materials, products, and processes mentioned within the following pages,
see the General Index at front of book*

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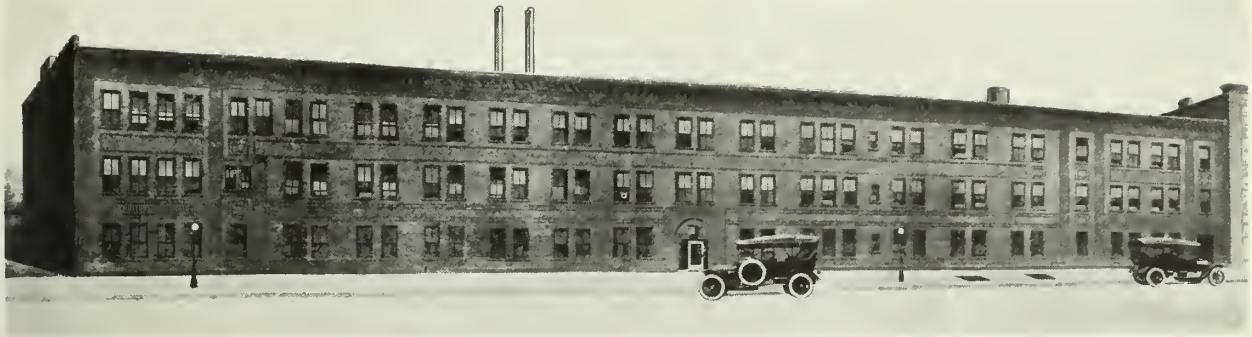
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207 East Ohio Street, Chicago, Illinois

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It is the task of Underwriters' Laboratories to secure and make available to all who may profit by it the best obtainable opinion regarding the merits of materials, appliances and systems in respect to the fire and accident hazards.

Equipment for this work includes a large plant at Chicago, a branch testing station in New York City and branch offices for the operation of inspections at factories and labeling of standard products in more than a hundred cities and towns in the United States and Canada, and in London, England. The Chicago plant occupies a three-story and basement building of the best modern fireproof construction, containing about 50,000 square feet of floor-space and provided with ample yard-space for huts and large testing furnaces.

The plant is kept well supplied with apparatus, much of which is of special design, for the proper performance of all necessary research work and for making laboratory tests in a thorough, systematic, comprehensive and practical way. There are about one hundred and fifty engineers and assistants on the Chicago staff. Each department is under the direction of an expert of long experience and much special training for his particular line of work.

The work of the branch laboratory at New York is mainly electrical testing.

Inspections at Factories and Labeling

A laboratory test on a sample material cannot of itself usually be depended upon as a reliable criterion of the quality of the daily output of the factory. Test work that ends when tests on a sample material have been completed is necessarily of limited practical value; the importance of proper check methods on run of goods is obvious. Years of study by Underwriters'

Laboratories of this problem of securing quality maintenance led to the establishment of its Label Service.

When the product of a manufacturer is admitted to the Label Service, following suitable investigation of sample goods, inspection is established in his factory. Inspectors and engineers in the employ of the Laboratories follow the daily run of material through various processes of production and conduct such tests as have been specified, and to goods thus found to be of suitable quality, Underwriters' Laboratories' labels are attached. Check-tests that cannot be conveniently made at the factory are made on samples forwarded by the inspector to headquarters. This service is further reinforced by tests on labeled material purchased from dealers and on samples of labeled product taken out of service and sent in from the field.

Thus, for a large class of products, the label on the goods or the absence of it, tells the architect, inspector, builder, and property owner whether the product has been inspected and passed.

PUBLICATIONS

(a) Organization, Purpose and Methods . . . 1917

The Laboratories also publish the following lists of manufacturers prepared to make standard products:

- (b) List of Inspected Mechanical Appliances.
- (c) List of Inspected Electrical Appliances.
- (d) List of Appliances Inspected for Accident Hazard.
- (e) Standards on Rubber-Covered Wires and Cords, Fire Hose, Fire Doors, Electric Cabinets and Cut-Out Boxes, and Lightning Conductors now ready for distribution. Other Standards in preparation.

NOTE: (b), (c), (d), revised semi-annually, sent free on request. (e) supplied at \$1 per copy.

ROBERT W. HUNT

JNO. J. CONE

JAS. C. HALLSTED

D. W. McNAUGHER

ROBERT W. HUNT & COMPANY

Engineers • Inspectors • Chemists • Metallurgists

Chicago New York Pittsburgh St. Louis San Francisco Montreal Toronto Vancouver London

Pioneers in their profession, Robert W. Hunt & Company maintain an International Bureau of Inspection, Tests and Consultation, composed of competent and experienced Engineers, Chemists, Metallurgists and Inspectors who are permanently employed in the divisions of Engineering and Inspection, and in the various Laboratories.

The Company maintains offices in the principal cities of North America and Europe. Resident members of the organization are in charge of these offices, and resident inspectors are maintained at all of the leading industrial centers of the countries in which these offices are located. The personnel of the present technical organization is the result of continuous conservative Engineering work during the past quarter of a century in the business of Inspection, Tests and Consultation.

Members of this firm were, even prior to the organization of Robert W. Hunt & Company, intimately associated with the Iron and Steel Industry in America. This long and successful service affords the assurance that any work entrusted to the Organization relating to the Metallurgy, Manufacture, Inspection, and Testing of Steel and Iron Products will receive the most thorough and careful attention. The developmental period of reinforced concrete construction lies within the life of the company, and, from the beginning, the testing of cement and other concrete materials, checking of plans, and supervision of construction have received continuous and ever-widening application.

The divisions of the Organization and their Departmental Sub-Divisions are as follows:

Engineering	{	Examinations and Reports	Laboratory	{	Chemical
		Consultation and Checking of Plans			Physical
		Construction and Testing			Electrical
Inspection	{	Structural Steel			Cement
		Rails, Fastenings, Cars and Locomotives			Micro-Photography
		Materials of Construction			

The knowledge, experience and ability, and the accumulated data of the various divisions of the Organization, are the property of all divisions, and are made use of freely in the interests of their clients. Highly specialized skill of many kinds has been welded into practical coöperation, capable of effective and rapid performance.

This effective coöperation enables the Engineering Division to make investigations and to solve Engineering problems in the most efficient manner.

The Inspection Service is under the direct supervision of the Engineering Staff, located at the various general offices, and engineering advice in connection with inspection work is freely extended.

The Laboratory Service maintained at all of their offices is an effective supplement to the work of the Engineering and Inspection Divisions. Over six hundred employees are regularly in the exclusive service of the company, and depression in general business conditions exercises little effect in their number or location. To properly serve their clients at all times, the Organization must be kept intact, and many men have been continued in their positions during months of idleness of the mills and shops where they are located. This policy, reinforced by salaries commensurate with the responsibility they are called upon to bear, has ensured the loyalty and absolute fidelity required in the performance of judicial functions.

The steady growth of the Organization indicates that such ideals are heartily supported by the Architectural profession, and further have established recognition of the Testing Engineer in ethical brotherhood with the other specialized branches of professional structural activity.

ROBERT W. HUNT & COMPANY

EQUIPMENT

The Robert W. Hunt & Company Bureau of Inspection maintains an extensive equipment of highly specialized cement, physical and chemical laboratories with specially trained chemists and inspectors, which combined with the fact that they have established offices in all parts of the United States, Canada and in Europe enables them to offer every advantage commensurate with first-class service to architects and engineers who desire to obtain the best of a manufacturer's output and protect their clients by full assurances of obtaining construction materials in strict compliance with the accepted specification.

It is a fact, beyond dispute, that Inspection Service is most efficient when rendered by men who are familiar with manufacturing processes, who are in constant practice, and continually on the watch for defects, whose profession is the detection of faults and who are acquainted with the practices at the different plants. Fewer inaccuracies escape such men than other men, no matter how highly trained technically, who undertake inspection only occasionally and who are detailed from an office or field force without special training in this specific line.

This Company has thoroughly systematized their inspection work and the points covered in inspection of construction materials are many and must be of interest to architects and engineers and to prospective owners of steel and reinforced concrete structures.

STRUCTURAL STEEL

Robert W. Hunt & Company's inspectors permanently located in the mills and foundries serve their clients by making a thorough inspection of the structural steel and iron used in construction, seeing that these materials are of the quality specified, of the proper section and free from injurious defects.

In the shop their inspectors serve their clients by a thorough inspection of all finished work, carefully checking each individual member, seeing that they are carefully fabricated in accordance with the plans and specifications, that the workmanship is first class in every respect, so that the various members will fit together properly at the building site, thus avoiding unnecessary and expensive delays. They will see that the material is properly cleaned and painted and use their best efforts to have the material shipped in the proper sequence so that erection may proceed without interruption.

REINFORCING STEEL

Their inspectors at the mills inspecting reinforcing steel select specimens from the various sizes of finished product of each heat, as rolled, on which they make cold bend and tensile tests, check the various sizes to see that they are of the proper section and that only accepted material is shipped, and furnish detailed reports covering each shipment and reports of tests identifying them.

SUPERVISION OF ERECTION

In the field their inspectors see that the various members are erected in the proper position, columns plumb, floors level, rivets tight and well driven and that painting is properly done.

CEMENT LABORATORIES

The inspection and testing of cement should be made at the mills or in warehouses and the strongest argument substantiating the need of testing and inspection of cement is the unconditional requirement of the standard specifications for Portland cement adopted by the American Society for Testing Materials and approved by the American Society of Civil Engineers which says: "All cement shall be inspected."

Such a recommendation or requirement would not be adopted by two such authoritative bodies of engineers and cement chemists without adequate basis therefor and it may be said that practical experience in the use of Portland cement had taught them that such a specification was necessary.

ROBERT W. HUNT & COMPANY

Of the value of Portland cement when "up to specifications" too much cannot be said. Of the danger of its use when unfit, also, too much cannot be said, and whether it is fit and therefore of great value, or unfit, and therefore of infinitely less value than nothing, can only be determined by the tests prescribed.

The testing of the aggregate, also of prime importance, should be made to determine suitability; the general character of the material, the grading and the cleanness are most important. Determinations can also be made to obtain the best possible and most economical mixtures.

Robert W. Hunt & Company maintain specially trained chemists and testers at each of their main offices, also experienced inspectors at the principal cement producing centers.

PHYSICAL TESTING LABORATORIES

The physical testing laboratories contain all standard testing equipment including tensile and compression testing machines of capacity from 200 pounds to 300,000 pounds, vibration testing machines, abrasion testing machines, complete metallographic apparatus, etc.

All standard tests of engineering materials can be made and special investigations of the relative merits of any materials of construction can be determined.

CHEMICAL LABORATORIES

At each chemical laboratory the equipment is complete for varied lines of materials, and for research work. The chemists are selected with great care and each laboratory is in charge of a chemical engineer of wide experience. Thoroughness, accuracy, and promptness are assured.

Architects, engineers and manufacturers are depending more and more on the chemist—in the first place to tell the architect and engineer the character of materials needed, and in the second, to tell the manufacturer how to produce them. Many organizations so interested maintain their own laboratories. To those who do not, Robert W. Hunt & Company offer their services for moderate fees.

ACCEPTANCE TESTS OF POWER PLANT EQUIPMENT

The Testing Department is prepared to witness and report upon performance tests of oil and gas engines; generators, motors, and other electrical apparatus; and centrifugal or reciprocating pumps at the manufacturers' works, thus securing the purchaser against the acceptance of power plant equipment which does not comply with the requirements of the specifications.

INSPECTION AND TESTING OF STEAM BOILERS

The advantage of boiler inspection during construction is emphasized by the many failures reported each year due to hidden defects. In the interest of public safety, thorough inspection cannot be too strongly insisted upon when ordering new boilers.

The inspection service this Company offers includes the inspecting and testing of the plates and tubes at the mills and supervision of the boiler during construction by competent men experienced in plate manufacture and boiler construction.

TESTS OF FLOORS, WALLS AND COLUMNS

The constantly increasing use of reinforced concrete and of terra cotta tile as a protective and structural material necessitates the testing of full-sized floor and wall sections, in order to obtain authentic data for the designing engineer and to demonstrate the durability, strength, and reliability of these materials in service.

Load tests of floors in new buildings are frequently required by architects and city building departments to demonstrate that the deflection under load does not exceed that permitted by specifications or by the rules of the department.

The Testing Department is prepared to witness and report upon load tests of slabs and floors, compression tests of walls and columns, and tests by fire and water on floors and walls.

Write for booklets containing standard specifications and describing services in Engineering Division and in Inspection of steel and cement.



Condensed Information

For the convenience of architects who desire in condensed form the principal facts bearing upon the successful use of Indiana Limestone we offer the following:

COLORS: Indiana Limestone is to be had in three distinct varieties: GRAY (a silvery, slightly bluish gray); BUFF (a delicate yellowish or warm gray); and VARIEGATED (a pleasing irregular mixture of the two).

These three principal varieties each offer a choice of lighter or darker shades. No two units of the variegated stone are apt to be alike, yet the color variation is never harsh or contrasty. It is therefore much liked for the interest it gives to flat surfaces.

TEXTURE: Indiana Limestone may be had in degrees of fineness from the texture of marble to distinctly coarse. One variety is so coarse as to be sometimes called American Travertine, and some very quaint and beautiful effects have been attained with it in various uses.

HARDNESS: Indiana Limestone, freshly quarried, is comparatively soft. It is non-crystalline and very homogeneous, but is extremely strong and bears the finest carving perfectly and permanently. Gray stone is the hardest variety. All varieties are of ample hardness for use underfoot in a residence, but in a building where the traffic is heavy special selection must be made.

MOULDED AND TURNED WORK: All turned work such as columns, balusters, urns, etc., and particularly all moulded work, is easily made by machinery at reasonable cost. Circular Indiana Limestone columns in all but the smallest sizes cost rather less than built-up wood columns. Fluted columns, unless they involve carving, etc., also are made entirely by machinery, with consequent economy.

SETTING: Indiana Limestone should be set in lime mortar or non-staining cement mortar. Portland Cement may be used under careful conditions, which we will gladly describe on request.

FINISHES: The mechanical finishes commonly used are smooth-planed and tooled. Rock face, especially with smooth or tooled trim, is considerably used. The "bats" of the tooled surface may be either grooves or flutes.

There are several other finishes in use and still others will occur to architects. The tooled finish, two bats to the inch, was recently devised and most successfully used by a prominent architect.

Architects are referred for more detailed treatment of the subject to Volume 1 of "The Indiana Limestone Library" and to Sweet's Architectural Catalog; Sweet's shows among other things, suggested forms of specifications.

Volume 4 treats of Indiana Limestone bank buildings exclusively and gives a long list of such, scattered over the United States and Canada. It is written for the banker but many architects find it interesting and a convenient means of exposition to their clients.

There is also a series of 8 inch by 11 inch plates showing, in plan and perspective, the Prize, Mention and other designs submitted in a "Competition for a Detached \$12,000 Residence of Indiana Limestone." A very interesting document.

Your name will be placed on our permanent mailing list on request and other Volumes sent as issued. The undersigned will be glad to answer specific questions and supply the booklets above alluded to, with samples, if desired.

Indiana Limestone Quarrymen's Association

Box 509, Bedford, Indiana

"Target-and-Arrow"

Brand of ROOFING TIN

Manufactured by

N. & G. TAYLOR CO., Philadelphia, Pa.

STANDS FOR

*Low Cost of Maintenance
Durability
Moderate First Cost
High-Grade Appearance*

A weatherproof, fire resistive and lightning protective roof which has back of it 107 years of continuous business experience.

What more can you wish?

Suggestions for laying a Tin Roof made in accordance with the standard working specifications adopted by the National Association of Sheet Metal Contractors.

Slope of Roof

If the tin is laid flat seam or flat lock, the roof should have an incline of one-half inch or more to the foot. If laid standing seam, an incline of not less than two inches to the foot. Less pitch is often successfully used but a good pitch is desirable to prevent any accumulation of water and dirt in shallow puddles, gutters, valleys, etc., and should have sufficient incline to prevent standing in them or backing up in any case far enough to reach standing seams.

Tongued and grooved sheathing-boards are recommended, of well-seasoned dry lumber, narrow widths preferred, free from holes, and of even thickness.

A new tin roof should never be laid over old tin, rotten shingles, or tar roofs.

Sheathing-paper is not necessary where boards are laid as specified above. If steam, fumes, or gases are likely to reach the under side of the tin, use some good waterproof sheathing-paper, such as black Neponset. Never use tarpaper. No nails should be driven through the sheets.

Flat-Seam Tin Roofing

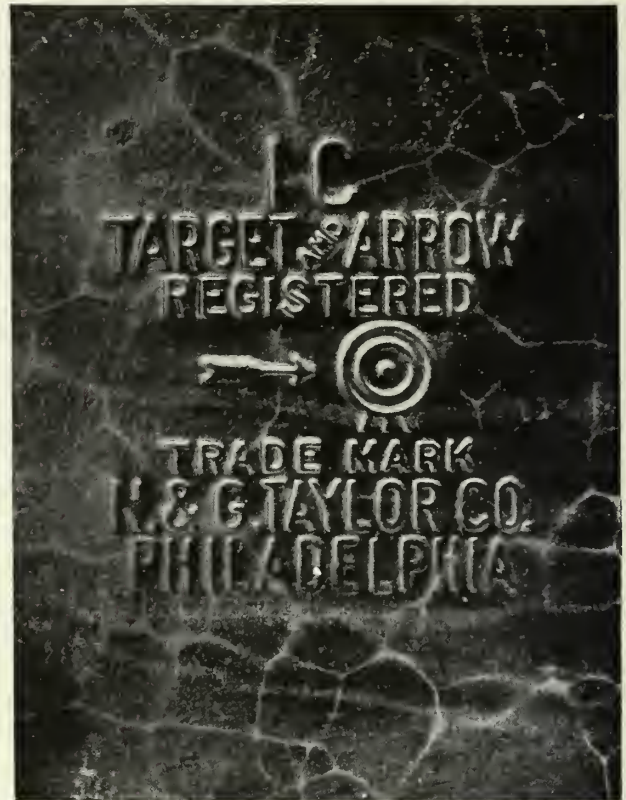
When the sheets are laid singly, they should be fastened to the sheathing-boards by cleats, using three to each sheet, two on the long side and one on the short side. Two 1-inch barbed wire nails to each cleat. If the tin is put on in rolls the sheets should be made up in long lengths in the shop, the cross seams locked together and well soaked with solder. The sheets should be edged $\frac{1}{2}$ inch, fastened to the roof with cleats spaced 8 inches apart, cleats locked into the seam and fastened to the roof with two 1-inch barbed wire nails to each cleat.

Standing-Seam Tin Roofing

The sheets should be put together in long lengths in the shop, the cross seams locked together and well soaked with solder. The sheets should be applied to the roof the narrow

Tables showing covering capacity and cost furnished upon request

N. & G. TAYLOR CO., Philadelphia, Pa.



Facsimile of trade-mark now stamped on each sheet of Target-and-Arrow Tin

way, fastened with cleats spaced one foot apart. One edge of the course is turned up $1\frac{1}{4}$ inches at a right angle, and the cleats are installed. The adjoining edge of the next course is turned up $1\frac{1}{2}$ inches and these edges are locked together, turned over, and the seam flattened to a rounded edge. (Illustrations showing these operations furnished upon application.)

Valleys and Gutters

These should be of 1X tin, and formed with flat seams, applying the sheets the narrow way. It is important to see that good solder is used, bearing the manufacturer's name, and guaranteed one-half tin and one-half lead, new metals, using nothing but rosin as a flux. The solder should be well sweated into all seams and joints.

Painting

All painting should be done by the roofer. The tin should be painted one coat on the under side before it is applied to the roof. The upper surface should be carefully cleaned of all rosin spots, dirt, etc., and immediately painted. The approved paints are metallic brown, Venetian red, red oxide, and red lead mixed with pure linseed oil. No patent dryer or turpentine to be used. All coats of paint should be applied with a hand-brush and well rubbed on. Apply a second coat two weeks after the first. The third coat to be applied one year later.

Sizes, Weights, Etc.

Roofing tin is usually furnished in two sizes, sheets 14 x 20 inches and 28 x 20 inches, packed 112 sheets to the box. "TARGET-AND-ARROW" tin is furnished in three thicknesses, 1C thickness (approx. 30 gauge U. S. Standard). 1X thickness (approx. 28 gauge). 2X thickness (approx. 27 gauge), etc. Weight per 100 square feet laid on the roof, about 65 pounds for 1C thickness.



*Two High Schools recently completed in Milwaukee
Van Ryn & De Gelleke, Architects
Equipped with Von Duprin Devices*

Approved!

Architects and Boards of Underwriters are severe critics—especially in devices pertaining to the saving of lives. It is only natural that they should be, for the responsibility placed upon them is a serious one.

Necessarily, therefore, they investigate thoroughly before they approve any such devices. Hence we apprise very highly the approval of

Von Duprin

Self-Releasing Fire Exit Latches

by such authorities as the National Board of Fire Underwriters, New York Board of Fire Underwriters, New York Bureau of Buildings, International Association of Building and Factory Inspectors—by architects in the service of our own and foreign governments—and by leading school and theater architects in all parts of the country.

Investigation on your part will undoubtedly lead you to the same conclusions. The strength, the simplicity, the durability of Von Duprin Devices have made them the standard of the world.

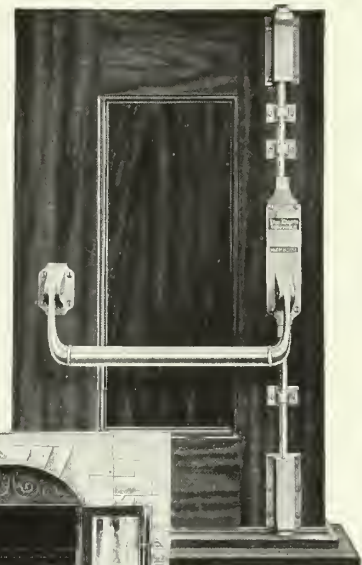
The slightest pressure on any part of the crossbar instantly and unfailingly releases lock and latches simultaneously.

Von Duprin Devices are always shipped ready for installation.

Our service department is always ready to cooperate with you and to advise you as to the Von Duprin design best adapted to meet your requirements. Ask for Catalog 12-S.

Vonnegut Hardware Company
Indianapolis, Indiana

Manufacturers and Distributors



GENERAL ELECTRIC COMPANY

G-E—Its Service to Architects and Engineers and Its Relation to the Electrical Features of Building Construction

The General Electric Company welcomes this opportunity to present in the Electric Issue of the Journal of the American Institute of Architects an outline description of its organization, manufacturing facilities, output and service, and to express its desire to coöperate with architects in perfecting and maintaining a uniform standard of excellence in the electrical installation and equipment of all buildings.

G-E INDEX TO SUBJECTS TREATED AND TO PUBLICATIONS REFERRED TO

G-E1 Resources and Unified Responsibility.

G-E2 Suggestions for Specifying Electrical Equipment.

G-E3 Universality of Production and Use.

G-E4 Sources of Energy—Electrical Apparatus

Publications:	G-E Bulletins
Steam Turbines	42206, 42201
Steam-Driven Generator	40500
Belt-Driven Generator	40400
Gas-Driven Generator	42400

G-E5 Control and Distribution.

Publications:	G-E Bulletins
Switchboards	"Standard Units" B-3303
Circuit Breakers	47502, 47503
Electrical Instruments	46013
Electrical Meters	42691, 46253, 46203

G-E6 Power Appliances—Electric Motors.

Publications:	G-E Bulletins
Induction Motors	41302
Direct Current Motors (constant speed)	41013
Direct Current Motors (variable speed)	A-4130
Direct Current Motors (crane and hoist)	48108

G-E7 Transmission—Wiring and Conduit Data

Publications, * also	
Sprague Bulletin	49600
Sprague Pamphlets	117
Various Sprague Folders	

G-E8 Local Centers of Distribution—Panel Boards and Cabinets.

Publications, * also Sprague Special Pamphlet, "Safety Panels"

G-E9 Switches for Every Use.

Publications: See Supply Catalogue, Remote Control Switches, G-E Bulletin A-4070

G-E10 Sockets and Receptacles.

Publications: See Supply Catalogues

G-E11 Utilization of Electrical Energy—Cooking and Heating.

Publications:	G-E Bulletins
Ranges, Domestic	B-3353
Disk Stoves, Domestic	B-3410
Radiant Grill, Domestic Table	B-3278
Ranges, Hotel	Y-898
Broiler, Hotel	Y-898
Ovens, Hotel	Y-898
Toaster, Hotel	Y-898
Air Heaters, Domestic	B-3423
Luminous Radiator	B-3329
Irons, Flat, Domestic	B-3318
Irons, Flat, Tailors'	B-3394

G-E12 Hotel Equipment.

Publications*

G-E13 Special Transformers.

Publications:	G-E Bulletins
Night Lamp	B-3341
Bell Ringing Systems	B-3400

G-E14 Fans.

Publications:	G-E Bulletins
Desk Fans	B-3367
G-E Ventilating Outfits*	

G-E15 Battery Charging Outfits.

Publication: G-E Bulletin B-3374

G-E16 Moving Picture Apparatus.

Publications*

G-E17 Illumination.

Publications:
Flood Lighting Projectors. G-E Bulletin 43850. Novalux Ornamental Units, 43503.
Ivanhoe-Regent catalogues and pamphlets.
Bulletins of Edison Lamp Works of the G-E Company.

G-E18 Generation, Transmission, Distribution and Application of Electric Power Everywhere.

*Information may be obtained at our nearest office. See page 158.

ITS SERVICE TO ARCHITECTS AND ENGINEERS

G-E1 Resources and Unified Responsibility

The factory, engineering and laboratory equipment of the General Electric Company is practically unlimited. Therefore, it is able to manufacture complete lines of apparatus, appliances and devices which possess the important features of uniformity and interchangeability to a degree possible only in the products of a single large manufacturer.

(A) Organization

The organization of the General Electric Company comprises subsidiary corporations specializing in all features of installation equipment that make it possible for G-E products to be adopted from the source of electrical energy to its fullest utilization within and without any type of building, monumental, industrial, or residential.

(B) Standardized G-E Equipment

It is entirely practical, therefore, for the architect to standardize with G-E equipment throughout. By this procedure all parts interrelate and much time and annoyance can be saved. The added advantage of having all electrical equipment provided by one company, ready for immediate installation and operation is obvious.

G-E2 Suggestions for Specifying Electrical Equipment

We believe that the sequence of presentation hereafter followed, the descriptions given, and the publications listed, will, with the known reliability of all G-E products and service, so impress architects that they may feel warranted in considering a paragraph similar to the following as most appropriate for inclusion in their specifications:

Wherever makes or names are mentioned in this specification for generators, switchboards, motors, wiring, conduits, fittings, switches, receptacles and all other electrical appliances or devices, and any alternative choice is provided, it is to be understood that preference will be given to that estimate, not necessarily the lowest, which proposes to incorporate in the contract and the building the greatest number of fixtures, fittings, and materials of a standardized line from one manufacturer under recognized names fully indentifiable on every piece or part of the equipment.

This suggestion is made with the full consciousness of the fact that no other maker can so fully meet the conditions, under all usual circumstances, as the General Electric Company and in the belief that the greater the quantity of materials of one reputable manufacturer which is installed under any one contract the greater is the responsibility of manufacturer and contractor on the one hand and the better served are the interests of both architect and owner on the other hand.

G-E3 Universality of Production and Use

The products of the General Electric Company comprise practically every kind of apparatus and machinery used in the generation, transmission, distribution, and use of electrical energy. Its thousands of products, in use in all parts of the world, have established the G-E Trade Mark as the Guarantee of Excellence on Goods Electrical. As in the past the General Electric Company will continue to be foremost in all developments and improvements tending toward the perfection of present electrical service and its extension into new fields of usefulness.

(A) Engineering and Sales Departments

For the convenience and use by architects, engineers, and the consuming public, in the coöperative development of a universal service and the highest standards of efficiency for both original installation and upkeep, the G-E Company has established a complete chain of sales offices which are listed on last page. These departments and the engineering staff are prepared to assist architects and engineers in any way desired in the planning, selection, and use of apparatus, materials, and devices most appropriate to each demand of service and to all climates, inspection and code requirements to which reference will be found under the various subdivisions.

(B) Publications and Informative Data

The G-E Company issues a complete series of publications, in the form of Bulletins and Supply Catalogues,

which are available to all architects and engineers. A list of those current is printed in connection with the Index for their convenience, and reference to these is made under the various subdivisions.

In addition to these certain tables of capacities and dimensions, space requirements, and other data pertaining to general requirements will be found in the G-E pages of Sweet's Architectural Catalogue (pp. 1425-1439 in 1917 edition) and recommendations, notes, and formulae of interest will be found in electrical information and data furnished by The Society for Electrical Development, Inc., also printed therein and referred to under 6A2 and elsewhere in this issue of the Journal. See also pages in Sweet's of Sprague Electric Works (1440) and of Ivanhoe-Regent Works (1466-1467).

It is a well recognized fact that a knowledge of the many functions which electricity performs in modern building practice is necessary to every architect. In this

GENERAL ELECTRIC COMPANY

outline description of G-E facilities and service, the methods of obtaining electric power, controlling it, and applying it to various uses are described and illustrated with concrete suggestions which will aid in the preparation of

electrical specifications for building construction. Complete detailed information will be found in the various G-E publications of interest structurally, under the G-E Index on p. 148.

G-E4 Sources of Energy—Electrical Apparatus

In designing an electrical installation it is essential to determine in advance whether central station current will be used or a complete power plant is to be installed. When central station current is available, it is generally conceded to be more economical, except in special cases, to use such power than to install a generating plant. In the latter case it is recommended that the current generated shall correspond to the class of current obtainable from the public service company, for in case of a breakdown of generating plant, central station power will be suitable, and there will be no occasion for interruption of service.

In any case, it is wise to consult with the central station management, as they are always familiar with the latest regulations affecting the industry, both those of the local city administration and of the local underwriters' inspection department. It is advisable also to confer with the latter authorities, the territorial jurisdictions of which are stated under 6A6.

As a rule, alternating current is used when transmission is over one-quarter mile, and where constant speed and constant service are required, and whenever lighting systems are the principal load. In buildings where stopping and starting of various machines will be frequent, and where a large number of adjustable speed motors are desired, or battery charging or electroplating is required, direct current is best adapted.

(A) Where Central Station Power is Available

When power is purchased from a lighting or power company it is possible to connect incoming wires direct to switchboard. Suitable switchboard panels with main switch and meters for measuring current should be specified when ordering switchboard. When incoming current is not suitable for requirements, it will be necessary to change the form of the current to meet these conditions by using motor generator sets, rotary converters, transformers, or mercury arc rectifiers. Whenever such conditions are encountered, it is advisable to get in touch with the nearest G-E office which, will gladly give detailed information.

For power stations supplying electric light and power to office buildings, machine shops, mills, etc., the Curtis steam turbines are admirably adapted for this class of work. Their operation is characterized by a minimum of vibration and noise. They are very compact, requiring minimum floor-space, headroom and attendance. The exhaust steam is free from oil and may be used for heating.

Turbine sets are available in sizes ranging from 100 kw. to 50,000 kw. for alternating current, and from 15 kw. to any larger for direct current.

Publications:	G-E Bulletins
Steam Turbines	42206, 42201
Steam-Driven Generator	40500
Belt-Driven Generator	40400

(B) Where Steam Power is Available

When central station service is not available for small isolated plants requiring 100 kw. or less, the steam engine generating set is used. These sets were designed originally to meet the severe conditions of marine work, which demand light, compact, and durable sets of close regulation and quiet operation. These sets have been used extensively for both power and lighting service.

When it is desired to provide for taking power from an outside source in case of emergency, double-throw switches may be added to main panel of the switchboard equipment.

For the production of electrical energy from mechanical sources of power, belt-driven generators are used. Such units are available in sizes up to 300 kw. for direct current and up to 500 kw. for alternating current.

Publications:	G-E Bulletins
Steam Turbines	42206, 42201
Steam-Driven Generator	40500, 44189
Belt-Driven Generator	40400

(C) Where No Power is Available

For rural residences, hotels, farms, country estates, rural railroad stations, camps, etc., electrical power and light is obtained from the internal combustion engine-driven generator set. Several of these sets are on the market equipped with G-E generators. These types of generators are also designed, and are available, for direct connection to gas engines of other manufacturers.

Publication:	G-E Bulletin
Gas-Driven Generator	42400

G-E5 Control and Distribution—Switchboard Data

For the control and distribution of current the General Electric Company offers a complete line of switchboards for all systems of electric distribution. These boards are equipped with latest improved instruments and controlling, measuring, and other devices.

All devices mounted on these boards are made by a single company, thus centralizing responsibility for the behavior of the entire switchboard and providing for the utmost efficiency in operation.

For the convenience or assistance of architects and consulting engineers, switchboard specialists are stationed in the principal branch offices of the Company. Architects and consulting engineers are invited to confer with these engineers in planning a switchboard to meet any unusual require-

ITS SERVICE TO ARCHITECTS AND ENGINEERS

ment or space condition. Sketches, detailed drawings, and specifications of any such special boards, or the adaptation of standard panels, will be furnished promptly on request.

While the General Electric Company will make any switchboard to meet any and every condition or requirement, it recommends, in the interest of economy and efficiency, that, wherever possible, fullest utilization be made of the very complete lines of standard panels which it has developed on the unit principle, known as:

(A) *G-E Standard Unit Switchboards.* These panels are so designed that they can be assembled in different combinations, to fit any usual condition and to form a complete switchboard having a neat uniform appearance, both front and back, all parts on the back being easily accessible. They are constructed for both direct and alternating current, complete with all switches, instruments and other equipment necessary.

They not only cost less than special boards but can be delivered quickly, completely equipped and ready for erection.

This is the most advanced system of switchboard manufacture and obviates the time and expense necessary when original specifications are drawn up for each individual installation by the architect, consulting engineer or contractor. Each panel is listed as a separate unit and has its own catalogue number. There are thousands of these "Standard Units," and they are listed in 22 separate lines for different classes of service.

(B) Construction Notes on Standard Panels

(a) *Panels.*—All panels are of slate, those for isolated or small plants, of dull black marine finished slate, and for central station boards, of natural black slate. Slate is $1\frac{1}{2}$ inches thick, with $\frac{3}{8}$ inch bevel. Widths vary from 12 to 32 inches; height of panel varies from 20 to 90 inches. The sizes being determined by the instruments and controlling devices.

(Panels of marble can be substituted at prices which may be obtained from any of the G-E offices.)

(b) *Framework.*—A complete supporting framework of $1\frac{1}{4}$ -inch pipe, with necessary fittings, is included for each panel. Total height never exceeds 90 inches.

(c) *Switches, Fuses, and Card-holders.*—The sizes and types of switches furnished with each panel are determined by amount of current carried, and their number depends upon the number of circuits which they control.

The fuses furnished in connection with switching apparatus open the circuits if overloads occur and protect the electrical apparatus.

One card-holder to designate the different circuits should be specified for each switch.

(d) *Connections.*—Each panel is furnished complete, unless otherwise specified, with small wiring on back of panel and with copper connections between the appliances which comprise the equipment of the panel.

The connections from generator to panel and from panel to all distribution points are invariably made by the electrical contractor and are not furnished by the manufacturers.

Publications.

The "Standard Unit" panel may be ordered direct from a bulletin. This is explained in G-E Index Bulletin No. 47001.

Details of framework are covered in G-E Bulletin No. 47750.

Rules governing the installation of switchboards will be found in the National Electrical Code, see Class A, Rules 3 and 4. Familiarity with all features of the Code, except details of manufacture, covered in Class D and supplemented by Underwriters' Laboratories' requirements and publications, is advisable on the part of all architects. The various rules epitomize the essential standards to be observed in installation and operation of all apparatus and devices.

Publications:	G-E Bulletins
Switchboards	"Standard Units" B-3303
Circuit Breakers	47502, 47503
Electrical Instruments	46013
Electrical Meters	42691, 46253, 46203

G-E6 Power Appliances—Electric Motors

The G-E motors cover a wide range of application of electric power to mechanical service. Constant and variable speed motors for both alternate- and direct-current service are built. Complete lines of these motors are manufactured, varying in size from 1-200 horsepower up to any requirement. Complete detailed information and illustrations pertaining to motors, with dimensions, space requirements and other data, will be furnished on request. State horsepower, voltage, frequency, etc., in making request.

Motors suitable for mounting on walls or ceilings can be furnished for installations where it is desirable to economize space.

Costs of installation can be greatly reduced by adhering to standard speeds. Contrary to the generally accepted idea, the cost of a motor of 1,800 RPM is less than that of a 1,200 RPM motor of the same horsepower. The 1,800 RPM motor is also smaller and lighter in weight.

The G-E service is available to all in connection with motor problems, and only those best adapted to the service required will invariably be furnished.

Publications:

	G-E Bulletins
Induction Motors	41302
Direct Current Motors (constant speed)	41013
Direct Current Motors (variable speed)	A-4130
Direct Current Motors (crane and hoist)	48018

GENERAL ELECTRIC COMPANY

G-E7 Transmission of Electrical Energy—Wiring and Conduit Data

It is a well-known fact that electricity is the simplest and easiest form of power to transmit. An old building is readily provided with a system of concealed wiring. A new building should be designed to accommodate the future as well as the present uses of electricity. One of the most important movements in this regard is the increasing use of electrical devices which consume more power than allowed on lighting circuits and, therefore, require heavier wiring. In any event, these devices can usually be operated at a lower cost if a separate wiring system on a power circuit meter is installed. Most electric companies give a lower rate when current is consumed on a special circuit in this manner, because such use represents a service furnished during the day when their equipment is not required to furnish current for the lighting service.

(A) Power Plugs on Separate Circuits

All power receptacles should be designed to take the same plug, and these should be made to fit only the power outlets, so as to prevent their attachment to the lighting circuits, which are not designed to carry the relatively heavy currents required by the power-consuming devices.

(B) Locate Distribution Centers in Easily Accessible Places

In planning various circuits, one should endeavor to locate distribution centers in easily accessible places, so that cutouts and switches controlling circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the different circuits, and all complicated and unnecessary wiring should be avoided.

(C) Provide for Future Uses in Installing Wires

When installing wires, ample outlets should be provided in all rooms for future use, to take care of the rapidly increasing use of electric devices of various sorts, included in which may be mentioned: electric vacuum cleaners, portable lamps, all kinds of heating apparatus and electric ranges and cooking utensils, small motors for various industries in office and other buildings, and for silver buffing, ice-cream making, sewing-machine operation dishwashers and washing-machine operation and for other conveniences in the home.

(D) G-E Motor-driven Office and Home Devices

As an indication of the almost unlimited possibilities in small electrically driven devices for home and office use it is of interest to note that there are on the market over three hundred of such with G-E motors attached.

(E) Study the Standard Symbols for Directions and Suggestions

For the greatest ultimate convenience and economy in the use of electricity, switches should be freely installed and receptacles placed at frequent intervals. Not only in the interest of standardization, but for the suggestions which will be afforded through the various conveniences which they provide for, it is recommended that the Standard Symbols for Wiring Plans as adopted by the National Electrical Contractors' Association and the American Institute of Architects be carefully studied at the time each installation is contemplated as well as followed in the marking of plans. These Symbols may be obtained or

seen as indicated under "Standard Symbols and Charts," 6E, 4, on page 79.

(F) Consult our Engineers about Present and Future Uses of Electricity

The National Electrical Code, in the General Suggestions which preface the Code, distinctly urges architects, when drawing plans and specifications, to make provisions for the channeling and pocketing of buildings for electric light or power wires as well as for all other means of transmitting electrical energy. To this the General Electric Company, in the interest of affording all architects and owners the satisfaction which will eventually come with the fullest utilization of electrical energy in manners not now fully foreseen, repeats the further recommendation that a new building should be designed to accommodate the future as well as the present uses of electricity. The General Electric Company also offers the facilities of its engineering forces in forecasting these and in drawing attention to every present advantageous utilization.

(G) The Question of Wire

For the transmission of electrical energy wire in one form or another is invariably the conductor. From the source to the outlet, for whatever form of use, current must pass through insulated wire.

Not only architects, but owners of buildings are now more fully alive to the desirability of calling for wire by a given name or brand. The National Electric Code formulates the basis of manufacture which the Underwriters' Laboratories elaborates upon in its requirements which become a precedent to its label service signifying compliance. But discriminating architects and appreciative clients are no longer content to specify or pay for wire or conduit that is the "best quality or equal." In addition to requiring the use of that which has passed the code and received the label, they encourage the use of that which in the competition of service and not of price aims to excel in one point or another the product that does not identify itself or its maker.

More and more frequently a distinction is being made as to quality in materials of building construction, and stronger encouragement is being given to those producers who, in spite of competition, adhere to their standards of manufacture and make names for themselves under established brands.

(H) Open Wiring and Conduit Work

Whether run "open" or in conduits, the quality demands of the wire must remain the best. There is an ever-increasing trend toward the use of conduits, whether flexible or rigid, in which to incase the wiring in all build-

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ings—on this point the General Suggestions of the National Electrical Code state “The use of wire ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended; and the method of accessible concealed construction is advised for general use.”

The *Quarterly* and other publications of the National Fire Protection Association are replete with instances where open and inferior wire has been the accredited cause of fires. In *Electrical Data*, one of the latest publications of Underwriters' Laboratories elsewhere referred to in the *Journal*, other instances are given. In the interests of safety and ultimate economy, conduit work is invariably recommended. Many cities now require this form of construction.

Nelson E. Thompson in “Mechanical Equipment of Federal Buildings” described under 6L in his chapter on “Conduit and Wiring Systems” states that all wiring in Federal buildings is run in rigid metal conduits.

(F) *G-E Wires and Cables*

Wires and cables are manufactured by the General Electric Company in varieties suitable for all uses of the architect. This product includes cable with weatherproof, flameproof rubber (National Electric Code and better grades to meet severer requirements), paper, varnished cambric, or asbestos insulation, and with all special finishes.

(a) *Rubber Insulation*.—Three types of rubber insulation have been standardized: Red Core, Tricoat, and 30 per cent Para (black or white core). In addition we are prepared to manufacture special types and grades of rubber-insulated conductors to meet unusual conditions.

(b) *Red Core* is a high-class insulation used primarily on wires for house-wiring, and exceeds the requirements of the National Board of Fire Underwriters.

(c) *Tricoat* insulation was designed for those desiring a very high-grade wire, somewhat better than Red Core, but less expensive than the 30 per cent grade.

(d) *30 per cent Para* insulation meets the Specifications of the Rubber-Covered Wire Engineers' Association and is the best rubber compound for absolutely high-grade work. The core may be white or black, as desired.

(e) *Braided Wire*.—All wires and cables No. 8 B. & S. and smaller carry a single braid, while No 6. B. & S. and larger are regularly made with either 2 braids or a tape and 1 braid; which, in accordance with Underwriters' requirements, is equal to double braid and suitable for conduit work. If tape and 2 braids are required, an extra charge will be made.

(f) *N. E. Code, Red Core*, braided, twin wire is finished with talc, which assures ease in pulling wire into conduits; no extra charge made for this feature. All our braided, rubber-covered wires may be finished in this way, if desired, without additional cost.

Our rubber-covered braided wires and cables are distinguished by 1 red and 1 black thread woven parallel in braid.

(g) *Weatherproof and Underwriters' Cable*.—Standard weatherproof wires and cables are manufactured strictly in accordance with the requirements of the National Board of Fire Underwriters, with 3 braids placed directly over the copper core, thoroughly impregnated with a black, weatherproofing compound, and then polished to remove all superfluous compound and give a smooth exterior finish. Double-braid weatherproof wire furnished on order.

When the number of braids is not specified, wire with 3 braids commonly called triple braid, is always furnished;

if double braid is required, requisitions or requests for quotations should so state. A stock of triple-braid wire is carried.

(K) *Steel Armored Conductors: A Safe and Economical Method of Wiring Old Buildings (also New)*

These consist of insulated wires with interlocking convex and concave galvanized steel strips wound spirally over the insulation.

Recognizing the necessity for a system of wiring which would be flexible, safe, economical and easily installed without disfiguring walls, ceilings, or decorations in existing buildings which were not originally wired for electricity and in which it became desirable to have the comforts and conveniences which electrical appliances afford, the Sprague Electric Works of General Electric Company eighteen years ago placed on the market a line of flexible armored conductors under the trade name “B. X.” These have been constantly adding to a well-earned enviable reputation.

Specify Greenfield “B. X.” flexible steel armored conductors, which in addition to use in existing buildings are equally well suited for new work as they make a safe, economical wiring system.

This Greenfield Sprague product is also made in cables known as “B. X. L.” which are covered by a continuous lead sheath over which the steel armor is wound. These are admirably suited for use in wet places and when embedded in concrete.

Publication: Sprague Bulletin No. 49600.

(L) *Flexible and Rigid Conduits*

(a) *Greenfield Flexible Conduit* is equal in flexibility to the above mentioned armored wires or conductors and can be used in a great many cases where it would be impracticable to use rigid conduit, particularly in finished building work.

This is made in Single Strip type and Double Strip type and is invariably furnished galvanized inside and out. For existing buildings the use of Double Strip Conduit is recommended on account of its extreme flexibility.

See Sprague Bulletin No. 49600 for all data on these conduits and for couplings, outlet, junction and switch boxes, covers and all fittings for conduits and armored conductors.

(b) *Greenfielduct* is a rigid pipe or conduit developed by Sprague Works. It is treated on both the interior and exterior by a patented hot galvanized wiped process making the galvanization of both surfaces and pores thoroughly effective. The interior is afterward given a black Japan finish the accidental removal of which will not impair the integrity of the conduit. This conduit is easily bent for installation and is proof against rust, cracking, flaking, and caking.

The enameling on the interior is *not* for the purpose of rust prevention as in some makes of galvanized conduits, but merely for identification of the product as an electrical conduit as required by the National Electrical Code, Rule 58-f.

(c) *Spragueduct* is a black enameled rigid conduit of the highest type to be used where item of expense is a consideration. The use of the galvanized or Greenfielduct is recommended as the cost is but approximately 7½ per cent more than the black pipe.

See Sprague Pamphlet No. 117 and other folders for data on (b) and (c).

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*(M) Sizes and Methods of Installing Conduits**(a) Code and Underwriters' Requirements*

The National Electrical Code prescribes the sizes, methods of elbowing, cutting, supporting and installing conduits, and the Underwriters' Laboratories standards obtain in manufacturing and labeling.

For the convenience of architects and engineers the National Electrical Contractors' Association has published a chart diagrammatically illustrating the Code requirements. This may be obtained as mentioned under 6A4b.

The brief summary and the table which follows will be of help in familiarizing readers with the more detailed requirements of the Code.

(b) Circuits Permissible in One Conduit

The same conduit must not contain more than four 2-wire or three 3-wire circuits of the same system, except by special permission of the Inspection Department and must never contain circuits of different systems.

No conduit tube having an internal diameter of less than $\frac{5}{8}$ inch shall be used. All elbows or bends must be so made that the conduit, or lining of same, will not be injured. The radius of curve of the inner edge of any elbow not to be less than $3\frac{1}{2}$ inches. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends of the outlet not being counted.

(c) Supporting Conductors in Vertical Conduits

In tall buildings special provision must be made to support the conductors in the vertical conduits, to remove their weight from their connections, and spacing of supports in such cases is prescribed in the Code.

In laying out conduit work, first ascertain the size and number of wires required, then take the size of conduit from the table in next column.

SIZE OF CONDUITS FOR THE INSTALLATION OF WIRES AND CABLES

NUMBER OF CONDUCTORS IN SYSTEM

	One Conductor in a Conduit Size Conduit, Ins.	Two Conductors in a Conduit Size Conduit, Ins.	Three Conductors in a Conduit Size Conduit, Ins.	Four Conductors in a Conduit Size Conduit, Ins.
Size B & S	Electrical Trade Size	Electrical Trade Size	Electrical Trade Size	Electrical Trade Size
14	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$
12	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
10	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	1
8	$\frac{1}{2}$	1	1	1
6	$\frac{1}{2}$	1	$1\frac{1}{4}$	$1\frac{1}{4}$
5	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$
4	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
3	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
2	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$
1	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2
00	1	$1\frac{1}{2}$	2	2
00	1	2	2	$2\frac{1}{2}$
000	1	2	2	$2\frac{1}{2}$
0000	$1\frac{1}{4}$	2	$2\frac{1}{2}$	$2\frac{1}{2}$
CM				
200000	$1\frac{1}{4}$	2	$2\frac{1}{2}$	$2\frac{1}{2}$
250000	$1\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3
300000	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3
400000	$1\frac{1}{4}$	3	3	$3\frac{1}{2}$
500000	$1\frac{1}{2}$	3	3	$3\frac{1}{2}$
600000	$1\frac{1}{2}$	3	$3\frac{1}{2}$	
700000	2	$3\frac{1}{2}$	$3\frac{1}{2}$	
800000	2	$3\frac{1}{2}$	4	
900000	2	$3\frac{1}{2}$	4	
1000000	2	4	4	
1250000	$2\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	
1500000	$2\frac{1}{2}$	$4\frac{1}{2}$	5	
1750000	3	5	5	
2000000	3	5	6	

G-E8 Local Centers of Distribution—Panel Boards and Cabinets

The next step in installation is the local distribution through the various circuits of the current brought by the feed-wires from the main source of control.

(A) Panelboards

G-E panelboards are compact and well finished, possess high-grade features throughout, and represent the latest and most satisfactory devices on the market. We can furnish a complete line of standard panels and are prepared to furnish promptly special panels to meet the most exacting specifications.

(a) Switches.—Individual circuits with the following arrangements can be supplied:

Fused terminals. Knife switches, punched clip or sweated and pinned. Rotary snap switches, moulded covers. Push-button switches, moulded covers. Safety type rotary snap switches. Safety type push-button switches.

Any of the above types may be fused between buses and switches, or outside of switches, with NEC enclosed, Edison plug or open link fuses.

Publications: See Supply Catalogue, and for Remote Control Switches, G-E Bulletin A-4070.

(b) Mains and Branches.—Highest grade copper, having 98% conductivity, is used for the mains and branches. The main terminals, bus bars, switches, and fuses are designed for a capacity of 6 amperes per circuit on 2 to

2 wire and 3 to 3 wire 125-volt panels, and 3 amperes per circuit on 3 to 2 wire 125-volt and 2 to 2 wire 250-volt panels. Mains can be arranged for lugs only, NEC enclosed or open link fuses, or with fused or unfused main switch.

(c) Frames.—By the use of a slate frame or set of barriers around the panel, a more finished appearance is given, as it separates the wiring in the cabinet from the active part of the panel.

This frame consists of four pieces of slate mounted on the face of the panel and fastened to the back of the cabinet by adjustable corner irons. The slot in the frame opposite each terminal, through which the wire passes, permits the complete wiring of the panel before the slate frame is placed in position and simplifies the work of connecting the circuit wires.

(d) Finishes.—Any finish desired or called for in specifications can be furnished, but the General Electric Company strongly recommends its No. 1, or dull black slate, with satin finished bar and branch connections. This is a very durable finish and renders the appearance of the panel very attractive.

(B) Safety-type Panels

This type of panel has been developed by Sprague Electric Works of the General Electric Company to meet an increasing demand for a strictly high-grade safety type of panel. It is so arranged that the switch compartment

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is covered by a door, fastened with a spring catch, while the fuse compartment is covered by a larger door, supplied with a lock. By this construction only authorized persons may have access to that part of the panel which is alive.

These panels are arranged for either push-button or rotary-snap switches, and NEC enclosed, open-link or Edison plug fuses in the branches.

Salient features.—Switches operated without opening door exposing current-carrying parts.

All live metal parts covered by lock door, eliminating possibility of shock to operator.

Unit switch construction.

Plates may be engraved with name or number of circuit controlled.

Recommended for use in all public places, department

stores, private residences, factories, or any place where the switches are likely to be operated by persons unfamiliar with the damage or possibility of personal injury caused by short circuit or accidental contact with live conductors.

(C) *Panelboard Cabinets.*—The General Electric Company has developed a complete line of standard construction cabinets in steel and wood with solid and glass doors and with and without trims. These can be furnished in any color or finish desired.

In addition to the standard line, special cabinets can be supplied to meet any requirement, but holding to the standards will effect an economy and facilitate prompt delivery.

G-E9 G-E Switches for Every Use

(A) *G-E Lever and Knife Switches* are constructed to withstand severe and constant usage, and they will carry their rated capacity indefinitely without overheating. Moreover, they embody certain other minor details of construction which, though not essential, add considerably to their efficiency.

(B) *Snap Switches.*—The General Electric Company manufactures a line of mechanically and electrically efficient snap switches in all standard rating, too numerous to be listed here.

(C) *G-E Flush Switches*, both push-button and rotary types, are known for their absolute reliability. They are furnished with adjusting nuts, which feature insures accurate alignment. The locking type is recommended for use in public buildings, to prevent the switch from being operated by unauthorized persons. Flush switch plates can be furnished in any finish required. White enameled plates should be used with delicately tinted walls and woodwork, and in bathrooms and toilets.

(D) *Luminous Radieye.*—The self-luminous "Radieye" pull-socket pendant or switch-plate attachment enables one to locate the exact spot for turning on the light, even from across the room.

These attachments contain an actual radium composition protected by glass. The luminosity is thus practically permanent. The body is made of brass with all standard finishes and can readily be attached to either pull-socket chain or switch-plate without the aid of tools.

(E) *Removable Mechanism, Flush Push-Button Switch.*—Constructed especially to comply with the restriction of the Underwriters in regard to having loose wires in buildings during erection. With this type of switch, only the porcelain box, with a temporary fiber cover, is installed with the wiring during plastering and other rough building operations. The removable mechanism, separately packed, is retained, ready for insertion as soon as there is no longer any danger of injury to it.

(F) *Remote Control Switch.*—The Type R, Form C-2, electrically operated remote control switch can often be used to advantage to connect and disconnect lighting circuits, motors not subject to heavy overloads, vacuum cleaners, or other electrical devices located at a distance. It is especially adapted for use in large buildings, libraries, theaters, halls, stores, etc., where control from a central point is desired.

Publications: See Supply Catalogue. For Remote Control Switches, see G-E Bulletin A-4070.

G-E10 Sockets and Receptacles

The standard and special lamp sockets made by this Company cover all possible requirements in electric installation.

(A) *G-E Quick Make and Break Socket*, 660 watts, 250 volts, fills a long-felt need for a key or pull socket which can be used interchangeably with keyless socket and switch control where electric heating devices and other small portables are used on lighting circuits.

(B) *G-E Locking Sockets and Receptacles* afford a positive protection to lamps and also prevent the theft of current. When the key is removed, the screw shell of the socket swivels freely, preventing injury to either the lamp base or the socket if an attempt is made to remove the lamp without the key.

(C) *Double Door Flush Receptacle.*—When installed in the wall or baseboard, only the small porcelain flange of the plug is visible. Two perfectly fitting doors in the plate open to allow the insertion of the plug.

(D) *Flush Receptacles for Electric Portables.*—This flush receptacle will take any medium screw base attaching plug. Catalogue No. GE002, for instance, is a miniature swivel plug, and is particularly well adapted to use with small electric portables in connection with receptacle, Catalogue No. 36817. The swiveling feature prevents the cord from twisting when the plug is screwed into the receptacle.

The very complete line of wiring devices manufactured by this Company includes a variety of other flush receptacles for use as outlets for various electric portables. For suggestion for use see Wiring and Conduit Data, G-E7C.

Publications: See Supply Catalogue.

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G-E11 Utilization of Electrical Energy**(A) Cooking and Heating**

A wide range of domestic appliances is now practical for the modern building. These devices are of vital interest to the architect in two ways. First, because the value of the complete structure as a working unit can be vastly increased by their use, and, secondly, because special wiring is invariably required and should be provided for in the original plans of the building. By installing separate wiring circuits and meter, as before stated, the charges for current consumption will be much lower than for lighting circuits.

Since the limit established by the Underwriters is 660 watts for a lighting circuit wire, the architect can readily determine the advisability of a separate circuit by noting the wattage of the various devices which will probably be used. Kitchen ranges, three-unit and four-unit radiators, circulating water-heaters, and air-heaters, for instance, are above the 660-watt limit, and must, therefore, be connected to the special power circuit wire.

The General Electric Company offers a complete line of electric heating and cooking appliances for domestic, hotel, and restaurant installations and industrial applications.

(B) Electric Ranges.—Are easy to operate, the heat is quickly available, and is readily regulated. They are clean, safe, and labor-saving, and their use promotes comfort and cleanliness. There is no fire requiring constant attention; no excess heat, smoke, or fumes, to vitiate the atmosphere. There is no longer need of continued scouring and scrubbing to keep cooking utensils clean and free from soot. Dust and dirt, together with the bother and burden of handling and storing coal and ashes, are entirely eliminated. The same current will always produce the same temperature; therefore, other things being equal, uniform results are obtained.

The electric range performs all kinds of cooking and baking. Ordinary cooking utensils are used with them. The broiler is combined with the oven, the meat being broiled by radiant heat from above. The cooking top is equipped with hot plates for boiling and frying and electric cookers for steaming and slow cooking.

(C) Flatirons.—3-, 6-, 8-lb. sizes. With separate or attached stand. Full nickeled or with barffed base.

(D) Tailors' Irons.—For tailors, clothing houses, and pressing-rooms in private residences, etc. Made in 12-, 15-, 18-, and 24-lb. sizes.

(E) Stoves.—Portable disks for many purposes. 4-in., single heat. 6-in. and 8-in., 3 heats each.

(F) Hot Plate.—Does the same work as the ordinary gas hot plate.

(G) Toaster.—Convenient and ornamental for use on the dining-room table. Makes fresh toast as needed. Ten slices cost one cent.

(H) Air-Heaters.—Particularly adapted for the heating of rooms in buildings or residences where the heat is to be used continuously. The heating units are so constructed as to allow a free passage of air over the heating element, the heat being rapidly conducted away to the surrounding air. Heating units easily renewable. Snap-switch heat-control.

(J) Glower Radiators.—Adapted for intermittent service, particularly in removing the chill before or after the heating system is in use. Ideal for nurseries and bath-rooms. Consists of a handsomely finished ornamental metal frame with a highly polished reflector, and two, three, or four luminous heating units. Safety from danger of fire or fumes.

(K) Circulating Water-Heater.—The circulating water-heater may be readily connected with the ordinary kitchen hot-water tank.

It is designed for low wattage continuous heating, but the larger wattages adapt it for intermittent use.

No tank or piping furnished.

Publications:	G-E Bulletins
Ranges, Domestic	B-3353
Disk Stoves, Domestic	B-3410
Radiant Grill, Domestic Table	B-3278
Ranges, Hotel	Y-898
Broiler, Hotel	Y-898
Ovens, Hotel	Y-898
Toaster, Hotel	Y-898
Air Heaters, Domestic	B-3423
Luminous Radiators	B-3329
Irons, Flat, Domestic	B-3318
Irons, Flat, Tailors'	B-3394

G-E12 Hotel Equipment

The complete G-E line consists of ranges, boilers, bake-ovens, toasters, and all other desirable utensils. Information in detail may be obtained from the nearest G-E office.

G-E13 Special Transformers

For small devices, such as bells, toys, small lamps, etc., the use of batteries has been replaced by small transformers which give the required low voltages at a small cost and without attention. Transformers can be used only on alternating current systems.

(A) For Night Light.—A miniature transformer (the All-nite-lite) is screwed to the lamp-socket in place of the ordinary lamp, and transforms the supply voltage to operate a 6-volt 2-c.p. bayonet base Mazda lamp, the same as used for automobile rear and speedometer lighting.

Publications: G-E Bulletin B-3341

(B) For Bell-Ringing Systems.—The Wayne bell-ringing transformer serves every ringing requirement. Catalogue No. 179541, for instance, is adapted for operating household type electric bells, annunciators, door-openers, thermostats, etc. It has sufficient capacity to operate three 3-inch bells simultaneously. It has been approved by Fire Underwriters.

A bell-ringing transformer should be included in all wiring specifications.

Publications: G-E Bulletin B-3400

G-E14 Fans

Fans for residences and offices are made in three sizes, 9, 12 and 16 inches in diameter, and with three-speed control except the 9-inch, which has a two-speed control. Can be furnished for desk or wall mounting, either oscillating or non-oscillating. These fans are quiet in running, light in weight, every efficient and durable. Made for different voltages for both alternating and direct current.

Publications: G-E Bulletin B-3402. For Ventilation of Buildings by use of electric blowers, fans and exhaust fans, ask for Special Bulletin devoted to this subject.

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G-E15 Battery Charging Outfits

Electrically propelled vehicles demand reliable charging equipments of high commercial efficiency. Battery charging equipments of all kinds can be furnished by the General Electric Company, either as individual charging sets with control panels for private garages or in large equipments for charging vehicle batteries in public garages.

Publications: G-E Bulletin B-3374

(A) *Individual Vehicle Charging Sets* may be used for charging either Lead or Edison vehicle batteries.

(B) *Ignition Battery Charging Outfits* can be supplied for home or garage use in charging automobile starting and ignition batteries. In the case of large garages it is best to take up individual requirements with the engineers of the General Electric Company.

G-E16 Moving Picture Apparatus

Fort Wayne Compensars for the production of voltage incident to the operation of moving-picture machines. Used for transforming direct or alternating current and transforming alternating to a usable direct current voltage. Simple to install; no sub-base or special foundations required; easily connected into circuit.

G-E17 Illumination—Interior and Exterior

Illumination has become one of the modern sciences. Its practice has developed the profession of illuminating engineering. The commercial demands for lighting efficiency, the varied effects both on the exterior and interior of buildings which may be produced by artificial lighting, and the development of a wide range of methods and devices for diffusing and directing light have necessitated specialized study such as now comes within the province of the illuminating engineer. There still remain the simple problems of modern lighting practice.

It is not here possible to explain the comparatively easy calculations involved in the design of a simple lighting installation. For information on this subject the reader is referred to the numerous handbooks and publications listed under the subdivision 6H in the June issue of the Journal. Further information is always obtainable from reputable manufacturers of lamps and lighting appliances who issue such data in convenient and reliable form.

Publications: The Ivanhoe-Regent Works of the G-E Company issues a complete catalogue on this subject, which is sent on application. See Bulletins of Edison Lamp Works of the G-E Company on Modern Lighting Methods in various Industries.

(A) Arrangements of Lighting Systems—Interior

Under the three following designations the lighting systems in modern practice are briefly outlined:

(a) *Local Lighting*.—Denotes concentrated illumination under small spaces, such as a lamp over a tool or machine or a piece of furniture.

(b) *General Illumination*.—Denotes an attempt to diffuse the same intensity of light throughout an entire room.

(c) *Localized General Illumination or Group Lighting*.—Denotes, roughly, a compromise between the two previous systems and suggests the placing of lamps to give proper direction of light and maximum intensity at important points.

(B) Types of Lighting Units

(a) *Direct Lighting*.—Denotes a type of lighting unit such as the clear or frosted incandescent lamp, where the light is not deflected by the ceiling or other reflective surfaces.

(b) *Indirect Lighting*.—Denotes a lighting unit, such as cove lighting or lamps concealed by inverted opaque reflectors, which reflect all the light on a ceiling or some other large surface, whence it is re-reflected in desired directions.

(c) *Semi-indirect*.—Denotes a light in which a translucent reflector is used. By this means most of the light is reflected to the ceiling or any other large surface, while a small portion of the light is transmitted directly through the reflector.

(C) Choice of a Semi-indirect Unit

The type of lighting unit which is best is a matter which does not fall within our province and upon which we express no opinion. Present practice tends toward the

use of the semi-indirect method, which is susceptible of wide variations according to the density of the bowl or reflector which governs their translucent quality. This density, in its direct application, is of course governed by the needs where it is used and each problem requires different treatment. In order that the lights may be evenly deflected from the bowl to the ceiling, the fixture or hanger should be carefully calculated as to length, and the proper position of the socket accurately determined. Wherever feasible, glass should be used which is smooth on the inside and on the outside also, if possible. Rough glass collects dirt and is not easily cleaned. The suspension should be such as to eliminate all danger of falling glass and should provide convenient means for cleaning. Decorations should be very simple, avoiding deep crevices, which invite dust accumulation.

(D) Exterior Lighting

The G-E Novalux ornamental units are well designed and are practical units built to accommodate the Mazda C lamp. They are used for lighting streets and sidewalks and for throwing light upward to illuminate building fronts. They combine lighting efficiency with an attractive appearance and are made for all standard lighting circuits and candle powers.

Publications: Information may be obtained at our nearest office; see page 158.

(E) Flood Lighting Projectors

Since the extensive use of flood lighting as applied to the exteriors of the buildings at the Panama-Pacific International Exhibition, the illumination of building exteriors has attained considerable prominence and popularity, due to the fact that the building and not the lighting method is presented to the eye.

The G-E Flood Lighting Projector is made expressly

GENERAL ELECTRIC COMPANY

for this work and accommodates either the 200- or 400-watt Mazda C lamps, which also are made expressly for this purpose.

Publications: See G-E Bulletin No. 43850

(F) For all Types of Illumination

Complete equipment, including glassware and lamps, is furnished by the General Electric Company and its subsidiaries.

For Opal Glass Reflector, Regent Semi-Indirect Bowls, Holophane Prismatic Reflectors and all other lighting

units, as well as for general information on the subject of illumination, including that from concealed sources, consult various General Electric publications.

(G) Lamps

The Mazda is the standardized lamp for all general uses. Mazda is not the name of a thing but the mark of a service, centered in the General Electric Research Laboratories at Schenectady, N. Y. The trade-mark, which is the property of the G-E Company, can appear only on lamps which meet the standard of Mazda service.

G-E18 Generation, Transmission, Distribution and Application of Electric Power Everywhere

Other products meeting every known requirement in electrical installation, as well as the equipment of buildings, are produced, including those for all industrial establishments, power-houses, hotels, apartment houses, residences and all other types of structures.

As before mentioned, the engineering staff and various departments of the General Electric Company are available to all architects and engineers through the principal works and sales offices of the General Electric Company which are established through the United States, Canada and foreign countries. See below.

The principal manufacturing plants of the General Electric Company are located at Schenectady, N. Y.; Lynn and Pittsfield, Mass.; Harrison, Newark and Watsessing, N. J.; Cleveland, Ohio; Erie, Pa.; and Fort Wayne, Ind. The total floor space is nearly 15,000,000 square feet.

To insure correspondence against avoidable delay, all communications to the Company should be addressed to the sales office nearest the writer.

THE SALES OFFICES OF THE GENERAL ELECTRIC COMPANY ARE AS FOLLOWS:

Atlanta, Ga.	Third National Bank Building	Los Angeles, Cal.	724 S. Spring Street
Baltimore, Md.	Lexington Street Building	Louisville, Ky.	Starks Building
Birmingham, Ala.	Brown-Marx Building	Memphis, Tenn.	Randolph Building
Boston, Mass.	84 State Street	Milwaukee, Wis.	Public Service Building
Buffalo, N. Y.	Electric Building	Minneapolis, Minn.	410 Third Ave., North
Butte, Mont.	Electric Building	Nashville, Tenn.	Stahlmann Building
Charleston, W. Va.	Charleston National Bank Building	New Haven, Conn.	Second National Bank Building
Charlotte, N. C.	Commercial National Bank Building	New Orleans, La.	Maison-Blanche Building
Chattanooga, Tenn.	James Building	New York, N. Y.	120 Broadway
Chicago, Ill.	Monadnock Building	Niagara Falls, N. Y.	Gluck Building
Cincinnati, Ohio	Provident Building	*Oklahoma City, Okla.	Terminal Building
Cleveland, Ohio	Illuminating Building	Omaha, Neb.	Union Pacific Building
Columbus, Ohio	Columbus Savings & Trust Building	Philadelphia, Pa.	Witherspoon Building
*Dallas, Tex.	Interurban Building	Pittsburgh, Pa.	Oliver Building
Dayton, Ohio	Schwind Building	Portland, Ore.	Electric Building
Denver, Col.	First National Bank Building	Providence, R. I.	112 Turks Head Building
Des Moines, Iowa	Hippee Building	Richmond, Va.	Virginia Railway and Power Building
†Detroit, Mich.	Dime Savings Bank Building	Rochester, N. Y.	Granite Building
Duluth, Minn.	Fidelity Building	Salt Lake City, Utah	Newhouse Building
Elmira, N. Y.	Hulett Building	San Francisco, Cal.	Rialto Building
*El Paso, Tex.	500 San Francisco Street	Schenectady, N. Y.	G-E Works
Erie, Pa.	Marine National Bank Building	Seattle, Wash.	Colman Building
Fort Wayne, Ind.	1600 Broadway	Spokane, Wash.	Paulsen Building
Hartford, Conn.	Hartford National Bank Building	Springfield, Mass.	Massachusetts Mutual Building
*Houston, Tex.	Third and Washington Streets	St. Louis, Mo.	Pierce Building
Indianapolis, Ind.	Traction Terminal Building	Syracuse, N. Y.	Onondaga County Savings Bank Building
Jacksonville, Fla.	Heard National Bank Building	Toledo, Ohio	Spitzer Building
Joplin, Mo.	Miners' Bank Building	Washington, D. C.	Evans Building
Kansas City, Mo.	Dwight Building	Youngstown, Ohio	Stambaugh Building
Knoxville, Tenn.	Bank & Trust Building		

*Southwest General Electric Company.

†General Electric Company of Michigan.

For Hawaiian business address

Catton Neill & Company, Ltd., Honolulu.

For all Canadian business refer to

Canadian General Electric Company, Ltd., Toronto, Ont.

For business in Great Britain refer to

British Thomson-Houston Company, Ltd., Rugby, Eng.

General Foreign Sales Offices: Schenectady, N. Y.; 120 Broadway, New York City; 83 Cannon St., London, E. C., Eng.

FOREIGN OFFICES AND REPRESENTATIVES

ARGENTINA: Cia. General Electric Sudamericana, Inc., Buenos Aires; AUSTRALIA: Australian General Electric Co., Sydney and Melbourne; BRAZIL: Companhia General Electric Co., Brazil, Rio de Janeiro; CENTRAL AMERICA: G. Amsinck & Co., New York, U. S. A.; CHILE: International Machinery Co., Santiago, and Nitrate Agencies, Ltd., Iquique; CHINA: Anderson, Meyer & Co., Shanghai; COLOMBIA: Wesselhoeft & Wisner, Barranquilla; CUBA: Zalso & Martinez, Havana; ENGLAND: General Electric Co. (of New York), London; INDIA: General Electric

Co. (of New York), Calcutta; JAPAN and KOREA: General Electric Co. and Bagnall & Hilles, Yokohama; Mitsui Bussan Kaisha, Ltd., Tokyo and Seoul; MEXICO: Mexican General Electric Co., Mexico City; NEW ZEALAND: The National Electric & Engineering Co., Ltd., Wellington, Christchurch, Dunedin and Auckland; PERU: W. R. Grace & Co., Lima; PHILIPPINE ISLANDS: Frank L. Strong Machinery Co., Manila; SOUTH AFRICA: South African General Electric Co., Johannesburg, Capetown and Durban.

Billiard Table Information for Architects

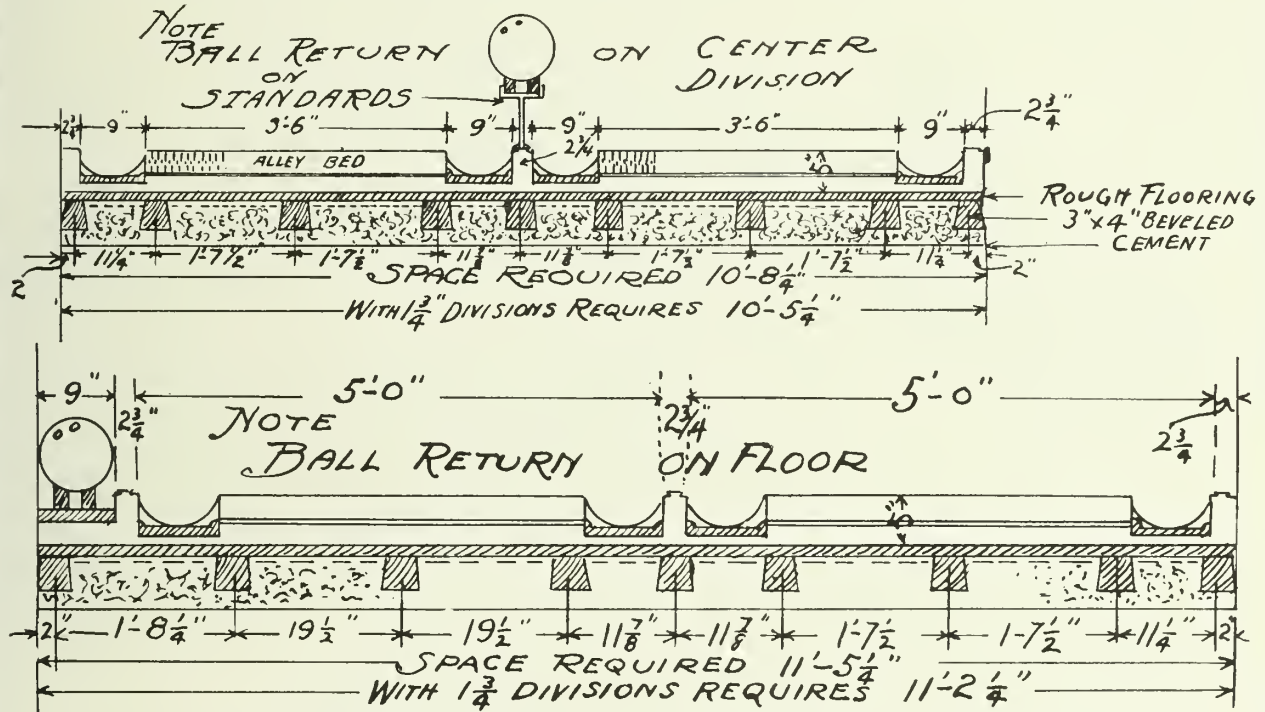
We make seven sizes of billiard tables. The space required for each of these tables is listed below:

Table	Outside dimensions	Room space required	Length of cue used
2½ x 5	2' 9" x 4' 10"	10' x 12'	42"
3 x 6	3' 4" x 5' 11¼"	11' x 14'	46"
3½ x 7	3' 11" x 7' 1"	12' x 15'	51"
4 x 8	4' 7" x 8' 5"	13' x 17'	58" (standard cue)
4½ x 9	4' 11½" x 9' 1½"	14' x 18'	58"
5 x 10	5' 5½" x 10' 1½"	15' x 20' (regulation table)	58"
6 x 12 ("English Table")	6' 8" x 12' 6"	16' x 22' (We recommend this size also for regulation tables, wherever possible.)	58"

For dimensions required to use two or more tables of any size or sizes, we will make suggestions and furnish complete information on request.

Bowling Alley Information for Architects

Below we present two drawings to show the minimum width required for a single pair of alleys, and the maximum width required when alleys are arranged in a larger series.



The length, from back wall to the front of the approach, should never be less than 82'-0". This allows for pit and swinging cushion 4'-0"; for alley (to foul line) 63'-0"; and for run-way 15'-0". Space for players' seats or for spectators should be in addition to the lengths and widths given.

For installations of all kinds, we invite correspondence. We will gladly and without charge make suggestions and furnish complete information to help in the solution of any bowling-alley problem.

The Brunswick-Balke-Collender Company

623-633 South Wabash Avenue, Chicago
29-35 West 32nd Street, New York City

A. B. SEE ELECTRIC

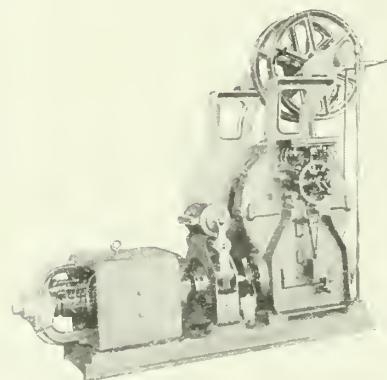
The A. B. See Electric Elevator Company
Manufactures and Installs all Types of
Electric Passenger and Freight Elevators:

Single and Tandem Gear Drum Type, Single and Tandem Gear Traction Type,
Heavy Duty Freight and Automobile Elevators, and Sidewalk Elevators

(All of the above may be operated by direct or alternating current)

Direct and 2-1 Gearless Traction Elevators

(For operation under direct current only)



A. B. See Single Gear Drum
Elevator Machine

THE DIRECT CONNECTED DRUM TYPE ELEVATOR

The Direct Connected Drum Type Elevator machine consists of a winding drum, connected by worm gearing to an electric motor, all mounted on a cast-iron bed plate. A brake placed between the motor and gear housing is released electrically in operating the car and in the event of failure of current from any cause brings the car to a stop gradually and smoothly.

Control. The elevator is operated by a controller, placed on or near the hoisting machine, connected by conducting cables with a switch in the car. A safety switch in the car releases a circuit breaker on the machine, when opened, cutting off all current from the motor and stops the elevator. Freight elevators are frequently operated by means of a flexible hand-rope passing through the car and attached to the operating mechanism on the machine.

Speeds. This type of elevator may operate at speeds of 100 feet to 400 feet per minute, the size of machine depending upon the lifting capacity, type of building, and character of service required.

Location and Installation. The drum machine may be placed in the basement or over the elevator hatch, the latter arrangement being preferable. In an installation

of this character steel guides are erected at the sides or corners of the hatchway attached to the building construction.

The car is suspended in a steel channel girdle or frame, to which is attached the iron hoisting cables, the other end being fastened to the drum. Counterbalancing is effected by means of weights, running in steel guides, connected by cables to the opposite side of the drum. When the counterweight is in two sections the top section is connected to the car. In this arrangement two hoisting and four counterweight cables are used. A car safety is placed under the platform connected by means of a cable to a centrifugal governor at the top of the shaft. When the car exceeds a predetermined speed the governor acts and operates the safety, bringing the car to a gradual stop.

An automatic stop motion on the machine provides means for stopping the car at the limits of travel. A slack cable safety is also provided to stop the motor if the car is obstructed in any manner while descending.

Coiled spring bumpers are placed under the car and counterweight in the elevator pit.

Safe Hoisting Attachment. In an office building, the character of which does not warrant the installation of a freight elevator, it is advisable to equip one of the passenger elevators with a safe hoisting attachment. The car girdle is equipped with a locking device to hold the car at the floors when loading and unloading safes.

Automatic Push-Button Control. In residences and for private use the Automatic Push-Button controlled elevator is installed. This type is operated by push-buttons placed at each landing, with corresponding buttons in the car. The elevator shaft doors are provided with locks and switches so that only the door at which the car has stopped may be opened. The car can not run unless all the shaft doors and the collapsible gate on car are closed. Pressing a button in the car or at any floor will send or bring the car to the desired floor. This type of elevator is also suitable for use in small apartment houses where a regular operator is not required.

GEARED TRACTION ELEVATOR MACHINE

The Geared Traction Elevator machine is designed for installation over the elevator hatchway. A wide grooved sheave is bolted to the worm gear, both of which are mounted on a shaft running in large bearings. The general arrangement of the motor and gearing is similar to the drum machine. An idler is fastened under the machine foundation beams.

ELEVATOR INFORMATION



A. B. See Single Gear Traction Elevator Machine

An Automatic Stop Motion, consisting of a series of switches built as an integral part of the elevator car controller, is operated by cams in the hatchway in such a manner as gradually to stop the car at upper and lower limits of travel independently of the operator. Ultimate limit switches are provided at top and bottom of hatchway, to prevent car overrunning in either direction.

A Controlling Switch is placed in the car for starting, stopping, varying the speed, etc. A safety switch also is provided for operating the circuit breaker to stop the car in case of emergency.

Independent conducting cables connect the car switches with the machine controllers.

The Speed of this type of elevator may be 150 feet to 450 feet per minute, depending upon the load and size of machine used.

GEARLESS DIRECT TRACTION ELEVATOR

The Gearless Direct Traction Elevator consists of a multipolar slow-speed motor, to the armature of which is attached the driving sheave and brake wheel, compactly mounted on a cast-iron bed plate, placed directly over the elevator shaft.

The power from the motor is transmitted to the car without gears by cables connecting the car and counterweight, passing over the driving sheave on the armature shaft, around an idler underneath and again over the driving sheave, to secure ample traction. Adjustable shackles are used to obtain proper tension on each cable.

The Car Control, counterweight, oil buffers, etc., are similar to those outlined for the Geared Traction Elevator.

This type of high-speed elevator runs 450 feet to 600 feet per minute. A magnetic speed governor regulates the revolutions of the motor. If the speed is excessive the governor operates the car safety device in the usual manner.

The 2 to 1 Gearless Traction Elevator is adapted for department stores or for lifting heavy loads at speeds of about 400 feet per minute. In this method a sheave is provided on the crosshead of the car and counterweight under which the cables pass, the ends being anchored in adjustable shackles attached to the overhead beams.

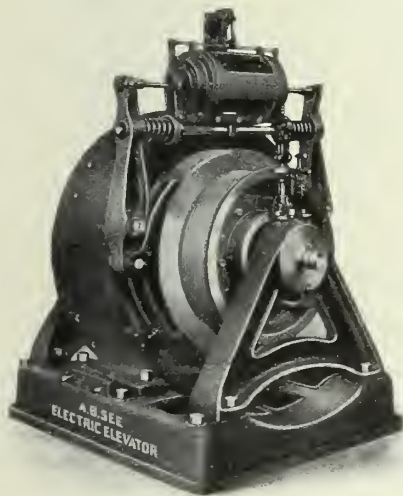
GENERAL INFORMATION GOVERNING INSTALLATIONS

On Gearless Traction Installations a hand traveling crane with chain fall should be provided over each bank of elevators to facilitate handling when making repairs. A trapdoor should also be placed in the penthouse floor so that the machinery may be lowered to the upper car landing, if necessary.

Ample room should be provided in the penthouse or machine-room to provide access to the machinery for oiling and cleaning. When machines are placed overhead, it is very important that sufficient means of ventilating the penthouse be provided to prevent motors overheating. On overhead installations it is recommended that a concrete floor be placed over the hatchway, openings being left for the cables to pass through, to eliminate noise and prevent dust in the shaft from settling on the machine.

The owner's work usually covers the following items: Provides shaft, enclosure, doors, and pit of proper depth at lower landing; supports for sheave beams or overhead machine foundation, track and support for traveling crane on traction installations; furnishes proper electric power, wiring and switches to bring current to elevator controller; provides outlet in shaft midway between bottom and top landings for light in car.

Architects are urged to consult our nearest office for information concerning elevator problems.



A. B. See Gearless Traction Elevator Machine

A. B. SEE ELECTRIC ELEVATOR COMPANY

220 Broadway, NEW YORK CITY

Philadelphia Baltimore Boston Washington Hartford Cleveland Montreal Toronto

This Association Offers a Real Service

The Associated Metal Lath Manufacturers is an organization of the producers of metal lath for the purposes of promoting better conditions in the manufacture, distribution and the methods of using metal lath.

The value of metal lath construction for resisting fire has been proven by fire tests conducted in different localities, and plans are now under way for a series of elaborate and complete tests by the Underwriters' Laboratories.

The acoustic properties of metal lath and plaster for partitions are being tested by the University of Illinois.

Standard specifications for metal lath construction have been adopted by the Association.

A handbook of metal lath construction, profusely illustrated, is distributed free of charge, and may be obtained by addressing the Association office or any of the members listed below.

Insure

the construction that you may design by specifying your metal lath by weight as well as by gauge.

Standardized Weights

24 gauge, 3.40 lbs. per sq. yd.	25 gauge, 3.00 lbs. per sq. yd.
26 gauge, 2.50 lbs. per sq. yd.	27 gauge, 2.33 lbs. per sq. yd.

THE ASSOCIATED METAL LATH MANUFACTURERS

901 Swetland Bldg., Cleveland, Ohio

AMERICAN ROLLING MILL CO., Middletown, Ohio
THE BOSTWICK STEEL LATH CO., Niles, Ohio.
THE GENERAL FIREPROOFING CO., Youngstown, O.
NORTHWESTERN EXPANDED METAL CO., Chicago, Ill.
SYKES METAL LATH AND ROOFING CO., Niles, O.

THE BERGER MANUFACTURING CO. Canton, Ohio.
CONSOLIDATED EXPANDED METAL CO'S
Braddock, Pa.
MILWAUKEE CORRUGATING CO., Milwaukee, Wis.
PENN METAL COMPANY, Boston, Mass.
TRUSSED CONCRETE STEEL CO., Youngstown, O.

Reproduced from the Metal Lath Handbook

Various Details of Suspended Ceiling Construction

INTEGRAL FABRIC USED IN SUSPENDED CEILING

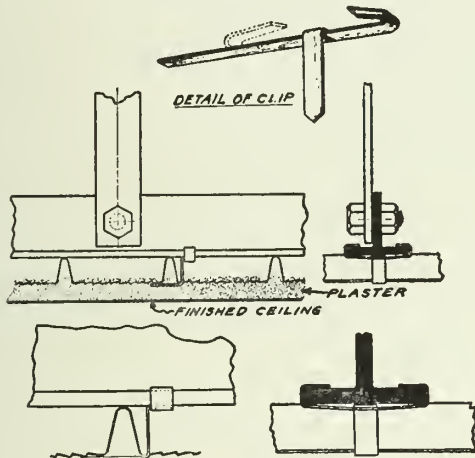


FIG. 32-D

SUSPENDED CEILING CONSTRUCTION AS USED WITH CONCRETE ROOFS

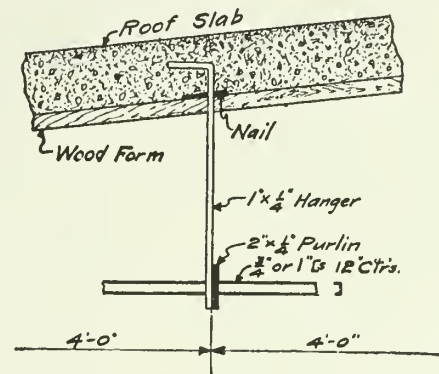


FIG. 32-J

A copy of this book will be forwarded upon request by any of the Member Companies or from the Commissioners.

SUSPENDED CEILING

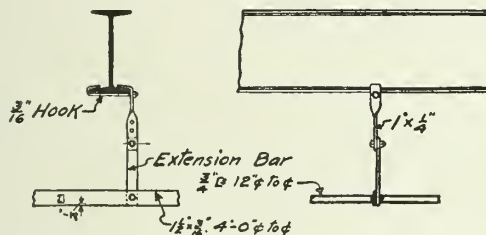


FIG. 32-G

SUSPENDED CEILING

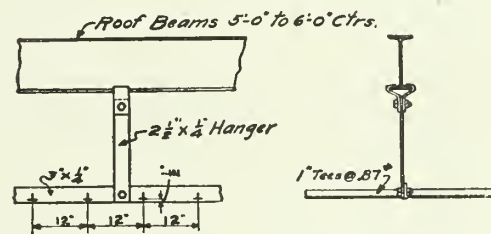


FIG. 32-I

The Metal Lath Handbook recommends Metal Lath of $3\frac{3}{8}$ lbs. weight.

The Manufacturers are standardizing material of the following weights:

24 gauge . . .	3.4 lbs. per sq. yd.	26 gauge . . .	2.5 lbs. per sq. yd.
25 " . . .	3.0 " " " "	27 " . . .	2.3 " " " "

To insure a standard material being used upon their work, Architects would confer a favor by specifying the weight as well as the gauge of the Metal Lath they require.

MEMBER COMPANIES

The American Rolling Mill Middletown, Ohio
 The Berger Mfg. Co. Canton, Ohio
 The Bostwick Steel Lath Co. Niles, Ohio
 Consolidated Expanded Metal Companies Braddock, Pa.
 The General Fireproofing Co. Youngstown, Ohio

Milwaukee Corrugating Co. Milwaukee, Wis.
 Northwestern Expanded Metal Co.
 918-950 Old Colony Building, Chicago, Ill.
 Penn Metal Co. 201 Devonshire Street, Boston, Mass.
 The Sykes Metal Lath & Roofing Co. Niles, Ohio
 Trussed Concrete Steel Co. Youngstown, Ohio

THE ASSOCIATED METAL LATH MANUFACTURERS
 901 Sweetland Building, Cleveland, Ohio

Metal Lath and Plaster Construction

The Associated Metal Lath Manufacturers have published a Handbook designed to place concisely before architects, contractors and others interested the best methods of using Metal Lath, giving illustrations and descriptions of various types of the material and observations by the best authorities on construction affected by its use.

In this Handbook are also given condensed records of various scientific experiments and reports of fire-tests made to determine fundamental data affecting the use of Metal Lath.

A copy of this book will be sent to all architects making request for it by any of the member companies or the Publicity Bureau of the Association. (See addresses below.)

Summary of Subjects Treated in the Metal Lath Handbook

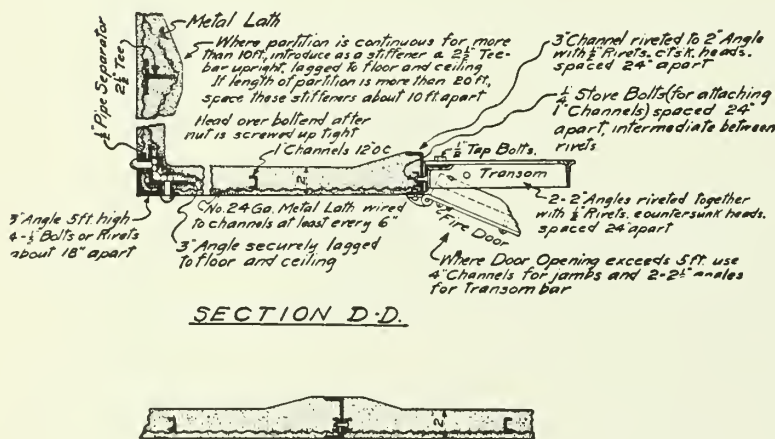
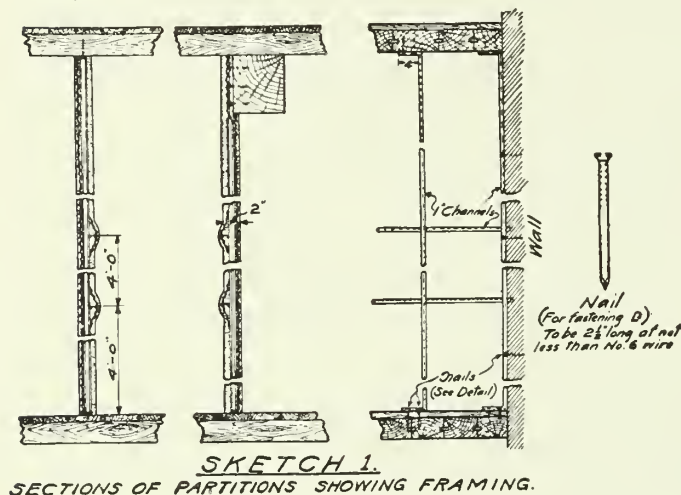
Report of Cleveland Fire-Test
Report of New York Fire-Test
Vertical Openings
Beltways
Elevator Enclosures

Beam and Girder Protection
Column Protection
Suspended Ceilings
Partitions
Specifications Interior Plastering

Specifications Exterior Plastering (Stucco)
Overcoating
Fire-Stops
Cornice and Cove Furring
Protection of Mill Construction

The Cleveland Fire-Test fully described with official pyrometer readings, curves, etc., in the Handbook was made in June, 1912, under the direction of Mr. Virgil D. Allen, Inspector of Buildings, who named as his committee to conduct the test, Mr. W. S. Lougee, City Architect; Prof. John H. Nelson, Case School of Applied Science; Mr. L. H. Miller, Bethlehem Steel Co. This showed Metal Lath and plaster construction an efficient fire-stop after exposure to fire reaching 1929° Fahr. for two hours, and the application of water at fire-pressure thirty seconds after the fire was withdrawn. The New York Test was made July 17, 1914, by Prof. James S. McGregor, under the regulations of the Committee on Fire-Hazards of the Industrial Board of the New York State Department of Labor and was equally convincing.

BELTWAYS. See description on page 165



SECTION A-A.

STANDARD DETAILS FOR
FIRE RETARDANT BELT ENCLOSURES
PLASTER & METAL LATH ON STEEL FRAME PARTITION
INDUSTRIAL SECTION

FIG. 28-A

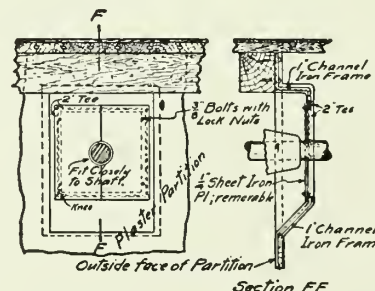
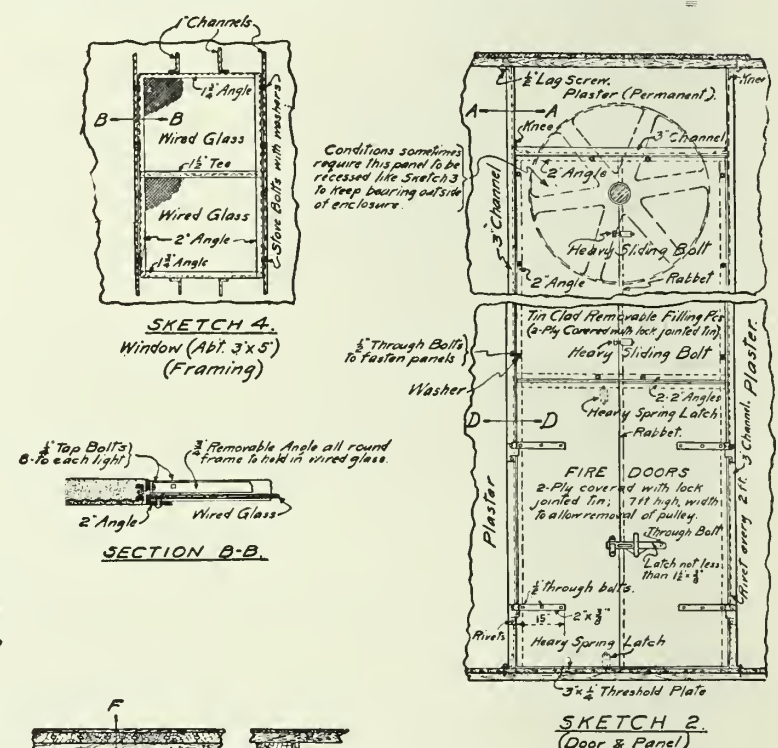


FIG. 28-B

STRUCTURAL SERVICE BOOK, VOL. I, 1917

SPECIFICATIONS FOR PLASTER
FIRST COAT. - 1 part Portland Cement, 2 parts sand, 1/2 part hydrated Lime.
All parts by volume, a sack of Cement being counted as one cubic foot.
One pound of long hair or fibre per bag of Cement.
SECOND COAT. - Same as first coat with hair omitted.
IF FINISH COAT. - Use 1 part Cement to 2 1/2 parts sand.

BELTWAYS, continued

The Associated Mutual Fire Insurance Companies (3A7), after much research, have had their Engineering Department design beltway protection with Metal Lath and plaster as shown by the cuts on page 164. Their Inspection Department also recommends this construction for non-bearing enclosures of stairs and elevators, and for setting off special hazards such as waste and oil supplies.

ELEVATOR ENCLOSURES

The Bacon fire in Boston and the McCrory fire in Pittsburgh have emphasized the efficiency of Metal Lath and plaster for elevator enclosures; they have stood after fierce conflagration monuments of their own efficiency, where brick walls had crumbled and steel beams were twisted. The importance of protecting the elevator shafts is recognized; the figures show a form of anchorage that typifies the best in construction, one for hollow Metal Lath enclosure, the other for 2½ inch solid wall. The materials in this type of wall yield naturally with the contraction and expansion, and their integrity is so assured that a constant can be used in computations.

DETAIL OF 4" HOLLOW METAL LATH PARTITION SHOWING ANCHORAGE FOR ELEVATOR SHAFTS, STAIR WELLS, ETC.

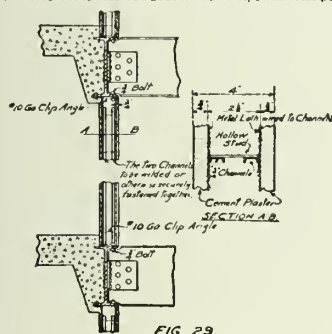
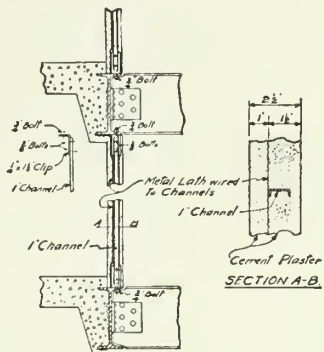


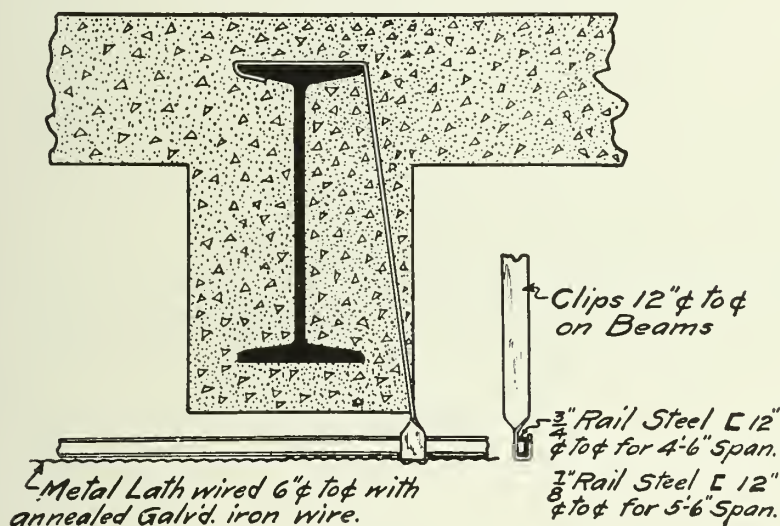
FIG. 29



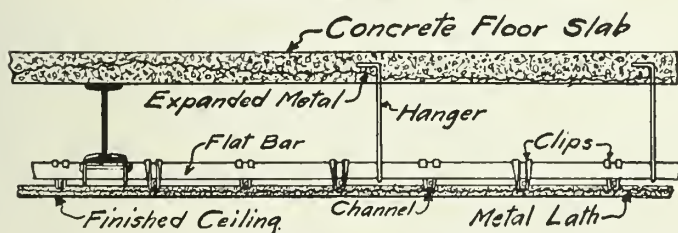
DETAIL OF 2½" SOLID METAL LATH PARTITION SHOWING ANCHORAGE FOR ENCLOSURE OF ELEVATOR SHAFTS, STAIR WELLS AND OTHER VERTICAL OPENINGS

FIG. 29-1

STANDARD CEILING DETAIL



SUSPENDED CEILING



The American Rolling Mill Co., Middletown, Ohio
The Berger Manufacturing Co., Canton, Ohio
The Bostwick Steel Lath Co., Niles, Ohio
Consolidated Expanded Metal Companies, Braddock, Pa.
The General Fireproofing Co., Youngstown, Ohio

The Sykes Metal Lath and Roofing Co., Niles, Ohio
Milwaukee Corrugating Co., Milwaukee, Wisconsin
Northwestern Expanded Metal Co., Chicago, Ill.
Penn Metal Co., Boston, Mass.
Trussed Concrete Steel Co., Youngstown, Ohio

OR THE

Associated Metal Lath Manufacturers Publicity Bureau
Sweetland Building, Cleveland, Ohio

SUSPENDED CEILINGS

(From report of Committee of Members of American Society of Civil Engineers.)

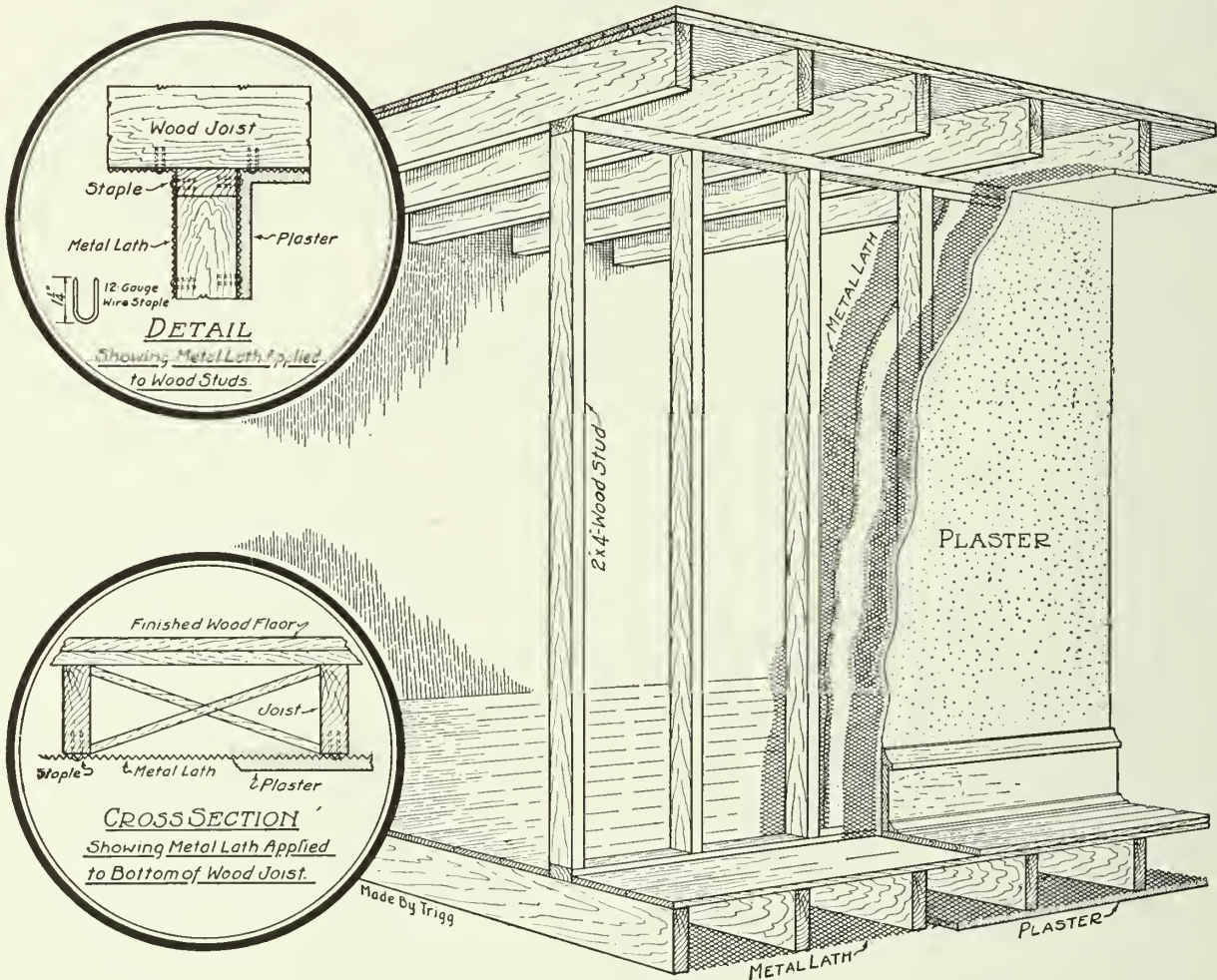
"It may be stated that one of the most obvious lessons taught by the San Francisco fire is the protection to concrete floors and floor-beams by the suspended ceiling of lath and plaster. In all cases where used it afforded complete protection—where not used concrete was destroyed and beams distorted."

The Metal Lath Handbook has diagrams covering all classes of suspended ceiling work, the construction of which is approved in the best practice. The San Francisco report quoted is a typical instance of results in actual service—columns and beams are similarly protected.

Further information upon Metal Lath and plaster construction will appear in these pages in the Industrial Section of the Journal from time to time. The engineering departments of the member companies will also give data upon any special construction required. The Metal Lath Handbook can be obtained from any of the following member companies:

Fire Retardant Partition

Expanded Metal Lath on 2" x 4" Wood Studs



In fire tests, this type of partition has held fire of 1700° heat in one room for over one hour.

It is particularly recommended for residence construction as a means of cutting down fire loss and providing a more substantial structure.

Care should be taken to join lath and plaster tight to floor and ceiling to prevent flame and sound being transmitted to next room.

Associated Metal Lath Manufacturers, Sweetland Building
Cleveland, Ohio
"What's Behind Your Plaster?"

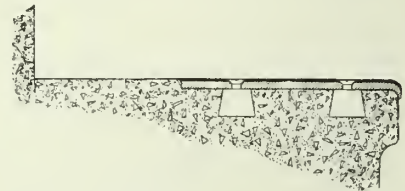
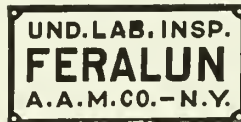
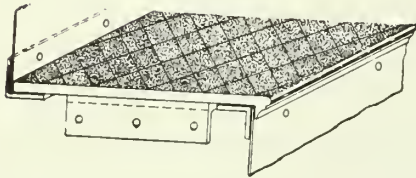
MEMBER COMPANIES

The American Rolling Mill	Middletown, Ohio	Milwaukee Corrugating Co.	Milwaukee, Wis.
The Berger Mfg. Co.	Canton, Ohio	Northwestern Expanded Metal Co.	918-950 Old Colony Building, Chicago, Ill.
The Bostwick Steel Lath Co.	Niles, Ohio	Penn Metal Co.	201 Devonshire Street, Boston, Mass.
Consolidated Expanded Metal Companies	Braddock, Pa.	The Sykes Metal Lath & Roofing Co.	Niles, Ohio
The General Fireproofing Co.	Youngstown, Ohio	Trussed Concrete Steel Co.	Youngstown, Ohio

ELIMINATE SLIPPING HAZARDS

IN a single year 170 people were killed by falls on Stairs and Sidewalks in New York City (Manhattan). Only 65 were killed by fires, 47 by elevators and 53 by surface cars.

The nation-wide agitation for Accident Prevention has brought forth new State and Municipal laws and requirements. The elimination of the slipping hazard has become essential in all types of structures; and Architects, Engineers and others concerned with construction are urged through these laws to specify for surfaces on which people must walk or work only those materials which are made and can be maintained in such manner that slipping and tripping casualties will be prevented.



"FERALUN" ANTI-SLIP TREADS

*Only Safety Tread receiving GRAND PRIZE from American Museum of Safety
Approved by National Board of UNDERWRITERS without qualification*

PREVENTABLE HAZARDS

Every surface of cast iron, steel or brass on which people must walk or work, constitutes an incipient hazard. Mud, oil, soapy water or concentrated wear make such surfaces dangerously slippery.

SAFETY SUGGESTION

"FERALUN," which is metal with an abrasive grit embodied in the tread surface, is not slippery even when covered with oil; is made in any desirable design; is extremely durable; and not expensive.

As a stair tread, "FERALUN" is particularly desirable as there are no heel catching grooves or projections; and the nosing edge, which is the contact point of the foot when descending, has the anti-slip element in it.

MODEL SPECIFICATION

1.—All concrete steps shall be equipped with American Abrasive Metal Co.'s "FERALUN" or equal anti-slip

treads approved for safety and fire-resistance by the Underwriters' Laboratories. These treads shall be set flush with the cement surface and firmly secured with cast iron anchors and screws. They shall extend continuously along the step to within 4" of strings; and in width shall be not less than $\frac{5}{8}$ the distance between nosing and riser.

2.—All other stairs (give location) shall have American Abrasive Metal Co.'s "FERALUN" (give style—"O," "K," "L," etc.) or equal one-piece anti-slip treads approved by the Underwriters' Laboratories for safety and fire resistance.

3.—Cement sidewalk vault lights shall have American Abrasive Metal Co.'s "FERALUN," or equal crosses, approved by Underwriters' Laboratories for safety, set flush in the cement between each glass.

4.—All (give forms—coal hole covers, elevator saddles and floor landings, etc.) shall be American Abrasive Metal Co.'s "FERALUN," or equal anti-slip tread, approved for safety by the Underwriters' Laboratories.

Also see SWEETS—send for sample and literature

AMERICAN ABRASIVE METALS CO.

Fifty Church Street

New York, N. Y., U. S. A.



Dominion Parliament Building
Ottawa, Can.



St. Columba's Catholic
Church, Johnstown, Pa.



Court House
Asheville, N. C.



Stanley Presbyterian
Church, Montreal, Canada



Court House
Uniontown, Pa.



Municipal Auditorium
Denver, Colo.



Municipal Auditorium
Houston, Texas



Court House, Ironton, Ohio



Jas. H. Matthews & Co.
Offices, Pittsburgh, Pa.



Temple Beth Zion
Buffalo, N. Y.



Court House, Wichita, Kansas



St. Cecelia's Catholic Church
Hastings, Neb.



Avondale Temple
Cincinnati, Ohio



Soldiers' Memorial Hall
Dayton, Ohio



American Bank Building
Suffolk, Va.



Court House
Scranton, Pa.



Second Presbyterian
Church, Wilkesburg, Pa.



Court House
Beaver, Pa.



Temple Israel
St. Louis, Missouri

Central Presbyterian Church
Denver, Colo.

Some of the Prominent Buildings Equipped With

Acoustile

THE PERFECTOR
OF ACOUSTICS

A permanent wall and ceiling treatment **GUARANTEED** to produce perfect conditions for hearing in all classes of buildings, both old and new, without marring the appearance or altering the design.

Acoustile meets all the requirements of the architect. It is sanitary, fireproof, and durable, and its surface permits of any scheme of decoration desired.

When designing auditoriums, churches, etc., architects may practically disregard the questions of form, proportion, and dimensions in so far as the acoustical effect is concerned. The proper introduction of the right quantity of Acoustile will give perfect conditions for hearing. This permits a latitude heretofore considered impossible where good acoustics were desired, and makes our patented Acoustile an indispensable item in building construction.

We maintain an expert engineering department which is entirely at your service without charge. We will gladly examine plans for any of your buildings, recommend proper surfaces to treat in order to obtain the best acoustical results, and **GUARANTEE SATISFACTION. ACOUSTILE HAS NEVER FAILED.**

Our new booklet, "Acoustile," describes the advantages of our distinctive service, and presents illustrations, specifications, and other data of real practical value to architects. YOUR COPY IS FREE.

Mazer Acoustile Company

ESTABLISHED 1909

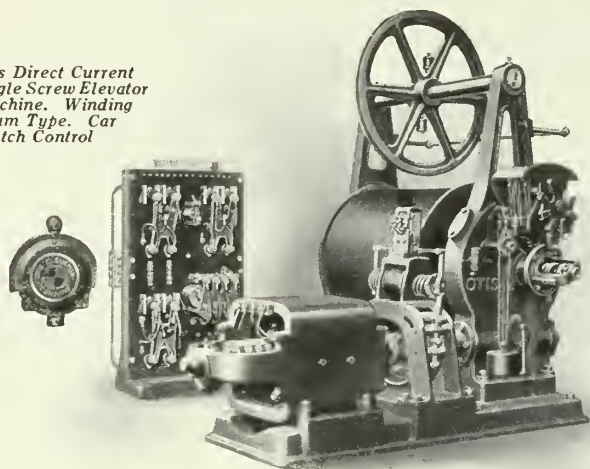
Acoustical Engineers and Contractors

529 Third Ave.

PITTSBURGH, PA.

ELECTRIC ELEVATOR INFO

Otis Direct Current
Single Screw Elevator
Machine. Winding
Drum Type. Car
Switch Control



Electric Winding Drum Type Elevators

With the winding drum type elevator the car is raised and lowered by winding and unwinding the hoisting ropes on a cast-iron drum. This type of elevator is used for high-grade service, passenger or freight duty. The machines are made to operate on alternating and direct current circuits and can be provided for light and heavy capacities.

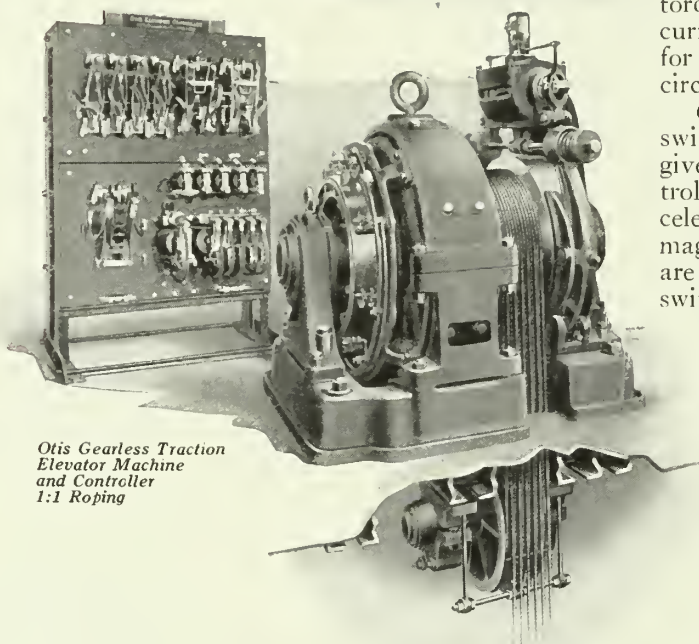
In this type of elevator, a worm and gear reduction is used between the motor and winding drum. Worm gear elevator machines are built in what are known as the single-screw and double-screw types. In order to preserve alignment, the machine parts are mounted on a continuous heavy iron bed. When it is desired to lift heavy loads at comparatively low speeds, a spur gear reduction, usually of the internal gear and pinion type, is provided between the worm gear drive and winding drum.

Motors.—For direct current circuits, moderate speed compound wound motors are used, combining high starting torque with reasonably low starting current. For alternating current circuits induction motors are used, which are wound for the proper voltage, phase and frequency of the supply circuit.

Control.—This type of elevator can be provided with car switch, push button or hand-rope control, so arranged as to give the attendant complete control of the elevator. The controller boards are provided with the necessary direction, accelerating and speed switches, all of which are of the electromagnetic type, except with hand-rope type controllers which are usually provided with mechanically operated reversing switches.

Safety Devices.—This type of equipment is provided with all necessary complete and effective safety devices to suit the respective equipment. These devices include machine automatic terminal stopping device, hatchway limit switches, slack cable device, car safety device, overspeed governor, etc.

Otis Gearless Traction
Elevator Machine
and Controller
1:1 Roping



Automatic Push-Button Electric Winding Drum Elevator

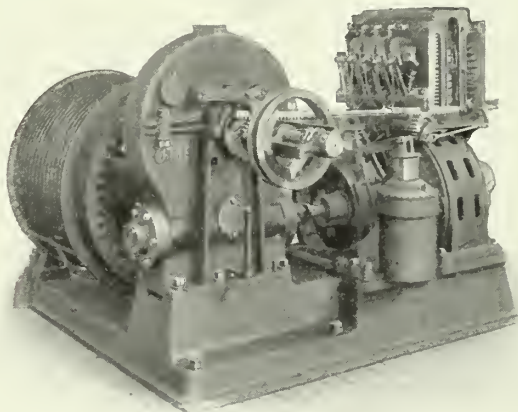
This type, with which many of the finest residences throughout the world are equipped, affords all the safety, comfort and convenience so long demanded for transporting persons from one floor to another. It is also applicable to small apartments, private business houses, banking institutions, and for freight and passenger service where an operator is not desired.

A series of push buttons automatically controls its starts and stops and does away with the necessity of an operator.

At each floor there is a button similar in appearance to the ordinary call-bell, which is pressed momentarily by the person wishing the car. If unoccupied, the car will start from whatever point it last stopped, come to the proper floor, stop and unlock the door. All the doors except the one opposite to which the car stops are automatically locked.

These elevators are built to operate on either Direct or Alternating Current Circuits.

Otis A. C.
Internal Geared
Elevator Machine.
Winding Drum
Type. Hand-
Rope Control



FORMATION FOR ARCHITECTS

Traction Sheave Type Elevators

With the traction sheave type of elevators, power is transmitted from the motor to the hoisting ropes by traction (friction) existing between the hoisting ropes and the traction driving sheave. One of the particularly prominent and inherent advantages resulting from this arrangement of ropes and method of driving them is the practical loss of traction obtained if either car or counterbalance is obstructed in its descent or bottoms on its respective oil buffer, causing complete cessation of further car motion, even though the driving member may continue to revolve. Another striking advantage of the traction sheave type of elevator results from the fact that the faces of the sheaves are entirely independent of the height of the building, and the machines may be used for any rise whatsoever.

Gearless Traction Elevator, 1:1 Roping

This type of elevator is the logical result of the present tendency to the greatest simplicity, combined with maximum operating economy and the highest possible degree of safety for high-rise, high-speed elevators.

The machine for this type of elevator consists of a motor, traction driving sheave and electro-magnetic brake compactly grouped and mounted on a continuous heavy iron bed. The motors used are of the slow-speed, shunt-wound, multi-polar type, especially designed for elevator service, and have a remarkably high efficiency. The compact and extremely desirable arrangement of parts permits of the greatest simplicity of installation and relative economy of space. Machines of this type are preferably located at the top of the hatchway. To date it has been built for direct current only.

Gearless Traction Elevator, 2:1 Roping

This type of elevator represents an adaptation of the 1:1 gearless traction type in which lower car speeds are obtained by roping the car and counterbalance 2:1, and by means of which the high efficiency of the gearless traction machine is combined with the lower car speeds. These elevators retain all the safety and controlling features of the 1:1 gearless traction elevator and are usually installed for car speeds ranging from 250 to 450 feet per minute.

Worm Gear Traction Elevators

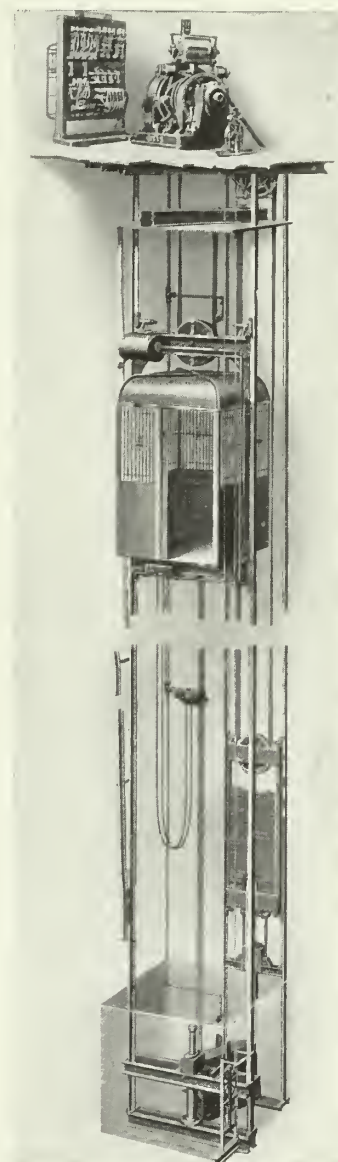
The machine used with this type of elevator is essentially the same as the winding drum elevator machines, the main difference being the substitution of a traction driving sheave for the winding drum. This type of elevator will give very satisfactory service in moderately high buildings requiring moderately high-speed elevators.

Coöperation, Specifications and Estimates

We cordially invite all architects to call upon us in laying out their elevator requirements. Because of the wide range of elevator apparatus which we manufacture and the diversified conditions of installation measurements, we find it impossible to show here exact construction requirements. We are willing at any time to lend our experience and facilities to work out with the architect plans for economical space arrangements and to submit estimates of cost.

Organization

Our complete organization, with offices in one hundred cities in the United States alone, makes this full coöperation possible. No matter in what part of the country the architect is situated, he will find an Otis office nearby. This element of personal attention, aside from the excellent quality of our elevator machines, makes the architect's dealing with this Company a most profitable and pleasing connection.



*Otis Gearless Traction Elevator
2:1 Roping*

OTIS ELEVATOR COMPANY

Eleventh Avenue and Twenty-Sixth Street, New York, N. Y.

OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD

Manufacturers of Passenger, Freight, and Sidewalk Elevators, Electric Dumbwaiters, Incline Railways, Escalators, Inclined Elevators, etc.

Leading architects everywhere are coming more and more to adopt Certain-teed Slate Surfaced Shingles for the residences they plan which require *artistic* and handsome shingle effect. These perfect shingles not only impart the beautiful appearance of solid slate, but blend with any type or color of wall—brick, frame, stone, cement—and are most economical in cost and service.

Certain-teed

Slate Surfaced Asphalt Shingles

are made of the finest quality roofing felts which are thoroughly saturated with our special blend of soft asphalt and then coated with a harder blend into which is pressed a heavy and even surface of *genuine* crushed slate in natural red or green.

This not only gives the solid slate effect, but makes a roof *doubly* weather-proof and spark-proof! Certain-teed Slate Surfaced Shingles are superior to wood shingles, look better, do not need painting, will not crack, buckle, split, warp, fall off or leak. They lie flat and stay flat. There is no waste in laying because each shingle is perfect and uniform. Their efficiency, beauty and economy are *appealing features* in view of the present high prices of metal, wood shingles and other roofing materials.

You take absolutely no risk in specifying Certain-teed Shingles because they are *guaranteed for ten years* by the largest manufacturer of prepared roofings and building papers in the world.

We invite you to write our nearest sales office for further particulars about these splendid shingles.

CERTAIN-TEED PRODUCTS CORPORATION

New York	Chicago	Philadelphia	St. Louis	Boston	Cleveland	Pittsburgh
Detroit	Buffalo	San Francisco	Milwaukee	Cincinnati	New Orleans	
Los Angeles	Minneapolis	Kansas City	Seattle	Indianapolis	Atlanta	
Memphis	Richmond	Grand Rapids	Nashville	Salt Lake City	Des Moines	
	Houston	Duluth	London	Sydney	Havana	





How to Write Conduit Specifications

"All conduit used in this work must be sherardized or galvanized on both interior and exterior surfaces, both of which surfaces shall be further protected by coatings of a transparent and acid-proof enamel over the sherardized or galvanized surfaces."

There's but one conduit which will come up to these specifications—**SHERARDUCT**.

SHERARDUCT, Sherardized Rigid Steel Conduit, will outlive any building in which it is installed. It is now, and has been for years, the choice of successful architects, engineers and electrical contractors in all parts of the United States and Canada.

Write today for catalogue and sample of **SHERARDUCT**.

National Metal Molding Co.

Manufacturers of

Electrical Conduits and Fittings

1124 Fulton Building

PITTSBURGH, PA.

Atlanta	Chicago	Los Angeles	Salt Lake City
Boston	Dallas	New York	San Francisco
Buffalo	Denver	Philadelphia	Seattle
	Detroit	Portland	St. Louis
Buenos Aires	Havana	Manila	Paris

S 20

Canadian Distributors—Canadian General Electric Company, Limited

AMERICAN MATERIALS CO., Inc.

Formerly American Flooring Co., Inc.

MAKERS OF

Plastic-Linoleum and
Amflorite Composition

FLOORS

101 PARK AVENUE
NEW YORK

SPECIFICATION FOR FOUNDATIONS

1. *General:* All under floors to receive our Floor must be cleared of all materials, rubbish, *plaster or lime droppings* and be delivered to us broom cleaned and thoroughly dry.

The surface of the concrete or wood under floor *must be brought up to within $\frac{3}{4}$ inch of finished floor level for Plastic Linoleum and to within $\frac{1}{2}$ inch for Amflorite Composition.* If this under floor is not up to, or is out of proper level, or is uneven or imperfectly laid or of defective material, such defects must be rectified before we begin work. Sloping or pitch must be produced in the under floor, so that our floors may be laid by us evenly on top thereof.

2. *Concrete Foundations*—(a) *Cinder Concrete* under floors should be made of Standard Portland Cement, clean sharp coarse sand, clean washed steam cinders, in proportion of at least 1, 2, 5, be well tamped, straight edged, free from holes, projections, soft or damp places, well bonded to foundation, and topped off with a mixture of 1 cement to 4 sharp sand, everywhere well bonded and thoroughly raked and scratched. The top mixture to be applied at the same time the concrete is laid.

This concrete to be brought in after the Plasterer has finished the white coat and the foundation has been thoroughly cleaned of all lime and plaster of Paris.

(b) *Stone Concrete* under floors should be made of Standard Portland Cement, with clean sharp sand and gravel and broken stone, in proportion 1, 2, 3. Otherwise same as under cinder concrete.

3. *Wood Foundation for Our Floors* must be well-seasoned lumber, preferably not over 4 inches wide, $\frac{7}{8}$ inch thick, securely nailed and firmly supported on joists or stringers to prevent sagging.

4. *Sanitary Base:* When our Base or Wainscot is to be applied on wall of brick, stone or terra cotta, a cement backing must be brought out to within $\frac{1}{2}$ inch of finished surface of Base. This backing to be mixed 1 Standard Portland Cement to 2 sharp clean sand, no plaster mortar or plaster putty to be allowed to run into mix, put on as a scratch-coat thoroughly well bonded or anchored and raked or scratched.

When our Base is to be applied to non-fireproof construction, expanded metal must be tightly stretched, nailed not less than every 8 inches and cement—scratch-coated as above to within $\frac{1}{2}$ inch of the finished face of Base.

Our Base cannot be applied directly to plaster block, or lime mortar unless such are thoroughly covered with a cement scratch-coat as before specified.

If wood backing is provided same must consist of good boards preferably not over 4 inches wide, securely nailed at least every 8 inches to blocking and brought to within $\frac{1}{2}$ inch of face of finished Base.

All plaster work both browncoat and whitecoat, to stop or be removed to not less than $\frac{1}{2}$ inch above top of finish base and patched by the General Contractor after our Base has *thoroughly set and dried and has been finished.*

5. *Iron Stairs, Landings, Duct Covers, etc.:* If Plastic Linoleum or Amflorite is to be applied over or on sheet or cast iron, same *must be sufficiently rigid to supply a solid foundation*, be painted and have $\frac{3}{8}$ - to $\frac{1}{4}$ -inch holes not further apart than 6 inches each way to enable us to fasten expanded metal to form the bond to the foundation.

If foundations are of cement or wood, conditions are as stated above, under paragraphs 2 and 3.

REMARKS

Fireproof Foundations may be brick, tile, cement, flags, or similar material, each laid on a solid foundation of its own. These materials are often applied on fireproof construction, at a level below the finished floor, the intervening space being filled up with some light fill, generally cinder concrete, used most extensively as a foundation for Composition Floors. In most cases the failure of such floors can be traced to improper use of the cinder concrete. Its application is often let out under contract to the cheapest man, who naturally applies the cheapest labor, little superintendence, and practically any material besides unwashed cinders to fill up the space. The mixing is done under like conditions; the consequence is that in some places the concrete is dense, in others absolutely porous with little or no cement, and the surface out of level. This cinder fill is generally put down at the convenience of the General Contractor and is often brought in before the Plasterer has commenced his work, thereby running the risk of filling the pores of the surface with lime and plaster of Paris droppings. Also the wear and tear caused by working on top of the cinder concrete results in worn-out places, loosened parts, and injury to the whole surface.

If the concrete foundation is laid with an uneven surface, the composition floor, whose surface must be level, will be thicker in some places than in others; such inequalities will cause unequal tension during setting and may develop strains so great that the floor will tear apart in the thinnest places. The even texture of the concrete foundation is necessary because otherwise the different suction will draw the liquid out of the plastic composition unevenly and thereby affect the color.

Non-Fireproof Foundation: See Clause 3 of our Specification.

A Composition Floor made of the proper ingredients and proportions by Manufacturers experienced with this product, laid by mechanics with thorough training in this trade, does not crack nor bulge on a proper foundation, and it has been proven in innumerable cases that the greatest percentage of failures can be attributed to bad foundations; it is not possible to produce a good floor over a bad foundation.

Protection: Our Floors should be laid as late as possible in the construction of the building because it is physically impossible for us after we leave a job to protect the floors against carelessness of other mechanics, and they should never be laid before the plastering is completed, the trim set, and the doors hung. The best protection is a $\frac{1}{2}$ -inch coat of dry clean pine sawdust. Paper should *not* be used; it prevents the action of the air and light on the floor, causing it to cure irregularly in color.

After Care: This has a great deal to do with the appearance of the floor. It is not possible to produce a floor which does not need cleaning. As a rule, a good Composition Floor is very easily cleaned, and needs but little attention. It can be cleaned in the ordinary manner with soap and water and possibly the additional use of steel wool to remove excessive dirt or stains.

AMERICAN MATERIALS CO., Inc.

Formerly American Flooring Co., Inc.

101 Park Avenue, NEW YORK

U. S. MATERIALS CO.

Weed Street and Sheffield Avenue, CHICAGO

*Manufacturers of***ELASTICA STUCCO****The Standard Magnesite Stucco**

Composition: ELASTICA STUCCO is a Magnesite Oxy-Chloride Cement. Magnesite is the cementing ingredient, as Portland Cement is in Portland Stuccos. Magnesite, mined originally as a white rock, is calcined, or burned, and ground to a fine powder between 140- and 200-mesh screen. The Mixing Compound, Chloride of Magnesium, serves the same purpose in ELASTICA that water does with Portlands. Chloride of Magnesium is a salt compound which has an affinity for, reacts with, and causes the set with Magnesium Oxide, commonly known as Magnesite Cement.

Scratch Coat: The Scratch Coat is of Magnesite, which is the cement; long-fibered asbestos, which serves as a binder; pure white, washed and graded Silica glass sand, which serves as a fill; and granulated cork, which is used for insulation and filler. Long-fibered asbestos, the binder, takes the place of hair, which is used in Portland Cements. Asbestos is a mineral matter and will not deteriorate and lose its value as a binder in a comparatively short time, as does hair. Long-fibered asbestos makes the material "fatty," makes it work easier under the trowel, and prevents it from creeping—falling on the plasterer's hock, so that he has to place it on the wall several times before it stays.

Finish Coat: The finish coat is composed of Magnesite Cement, short-fibered asbestos, pure white washed and graded Silica glass sand (graded to form a perfect mass and fill all voids), and various oxide mineral colors, according to the color desired.

Dash Coat: The Dry Rock Dashes, which form the last coat, are made from solid granite, quartz, and other stones. They are ground to a size from $\frac{1}{8}$ - to $\frac{1}{4}$ -inch. We use only such stones as are hard and lasting and will not deteriorate under weather conditions. All raw materials which enter into the composition of ELASTICA are of the highest grade obtainable, and all are thoroughly analyzed before being used.

Non-Conductor of Heat and Cold: ELASTICA STUCCO is an absolute non-conductor of heat and cold. Magnesia is one of the best insulation materials on the market today. Magnesia is used for pipe-covering as an insulation, and Magnesia for firebrick in steel mills where imperviousness to extreme heat is absolutely necessary. It is used for refrigerating plants as an insulation, as is cork. ELASTICA, being an absolute non-conductor of heat and cold, makes the house warmer in winter and cooler in summer. ELASTICA, because of its slight expansion when it sets, does not contract and crack, but makes an absolutely monolithic job and adheres closely to all openings around doors and windows, thus keeping out the cold weather.

Fireproof: ELASTICA STUCCO is absolutely fireproof. The use of Magnesite in steel furnaces and firebrick will confirm this. Possibly the least fireproof material in the composition of ELASTICA is the Silica glass sand. The fireproof qualities of ELASTICA make it a far better risk as a building material for insurance companies than other materials, and its use reduces the rate.

Waterproof: ELASTICA is absolutely waterproof. We would advise disposition of this question by merely making a test of a sample which we will send on application. The waterproofness of ELASTICA will be readily apparent.

Factory Mixed: ELASTICA is a factory-mixed product. This insures an absolutely uniform cement as to proportions of ingredients and coloring matter. Every bag of cement is exactly the same. This has been one of the most vital drawbacks of stucco as a building material. In most other stuccos, the mix is left to an incompetent workman who mixes the material on the job. Every pound of material which enters into the composition of ELASTICA is thoroughly weighed and mixed at the factory for an exact length of time in the most efficient mixing machine made.

Variety of Finishes: ELASTICA may be obtained in a great

variety of finishes. The finish coat is made in green, red, buff, brown, or white; in addition, any dash may be applied over these colored backgrounds. There are 70 to 80 different finishes to select from. Effects are produced by the use of granite, quartz, and other dashes. Two or more colors may be used on a house. This gives a very pleasing contrast.

Elasticity: ELASTICA STUCCO possesses an elasticity which, considering the hardness of the material, is exceptional. ELASTICA, while being hard and possessing four or five times the tensile strength of Portland Cement, is elastic and will not crack unless an unusual amount of settling takes place or the building is not properly constructed: where the studding, sheathing, lath, etc., are not properly secured or nailed.

Durability: ELASTICA is extremely durable and will not crack because:

1. ELASTICA is factory mixed.
2. ELASTICA is absolutely waterproof, and so does not permit of dampness penetrating the backing over which it is used.
3. ELASTICA expands slightly while setting, and weather changes have no effect on it.
4. ELASTICA takes up shrinkage and expansion of lumber without the material cracking.

Various Constructions: ELASTICA can be applied over any construction now being used for buildings. It may be used with perfect satisfaction over brick, hollow tile, wood lath, or patent sheathings. We advocate using wood lath or patent sheathing, because ELASTICA gives perfect satisfaction over these less expensive wood constructions.

Old Frame Buildings: There is also a large field for ELASTICA in old frame buildings. A frame house, properly kept up, must be painted every two or three years. By putting ELASTICA on these buildings, one eliminates the expense of repairing and painting. It gives the house a fireproof exterior, beautifies it, and makes it warmer in winter and cooler in summer. While the cost of stuccoing a frame building is greater than painting, in the long run it will be cheaper, because there is no future expense of upkeep. If the siding on a frame house is securely nailed, one may lathe diagonally over the siding, following regular wood-lath specifications. Covering a building with ELASTICA materially reduces the fire-insurance rates.

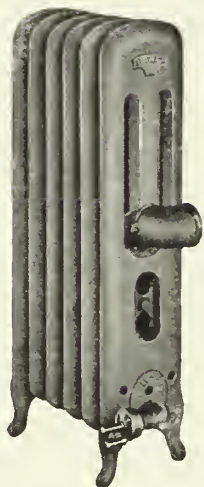
Cost and Covering Capacity: One ton of ELASTICA, two coats, each coat $\frac{1}{4}$ -inch thick, will cover between 85 and 100 yards to the ton, depending upon the construction over which it is used; over $1\frac{1}{2}$ -inch wood lath, lathed $\frac{1}{8}$ -inch apart, about 90 yards to the ton, or better, will uniformly be obtained; over patent sheathings, about 85 to 95 yards to the ton; and over tile or brick, between 75 and 90 yards, depending entirely upon the way the job is lined up. The dry rock dash will uniformly cover about 200 yards to the ton. From these estimates it is easy to figure the cost per square yard for material. In figuring the covering capacity, no allowance is made for openings, unless a single opening contains 6 square yards, or more, in which case it is deducted.

Cost of Applying: ELASTICA can be applied a great deal cheaper per square yard for labor than other stuccos for the reasons:

1. That it is a factory-mixed product, eliminating a great deal of labor on the job in mixing ingredients.
2. Because it works easily under the trowel and covers many square yards more than other stuccos, giving a saving in tonnage.

Freezing Weather: ELASTICA can be applied equally satisfactorily in warm weather or in weather below zero. It will not freeze. It is mixed with a Chloride of Magnesium, a chloride salt solution, and positively will not freeze under the severest weather conditions. Buildings may now be covered at any time during the year.

Ventilating Gas Radiators— —Hawks System



6-Section No. 52. Cast Iron. 30 feet radiation

A FLEXIBLE system of individually gas-fired radiators, trim in appearance, resembling a steam installation. Use iron pipe or tile vents. Draw fresh air continually into the room like a fireplace, but without draft.

Advantages: positive ventilation; clean fuel; quick, economical, convenient heat, always ready.

Construction simple, with no parts to get out of order.

Efficiency high because of long circulation path for vented gases (see cut). Burner enclosed within radiator. Operate by natural draft, without fans. No water, steam, valves or gauges.

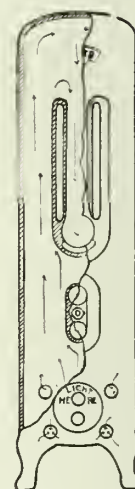
Types in heavy cast iron, or 22-gauge, Rust-Resisting Armco Iron.

See page 1318, Sweet's catalogue, 1917, or drop us a card for further particulars.



HUGO MFG. CO.

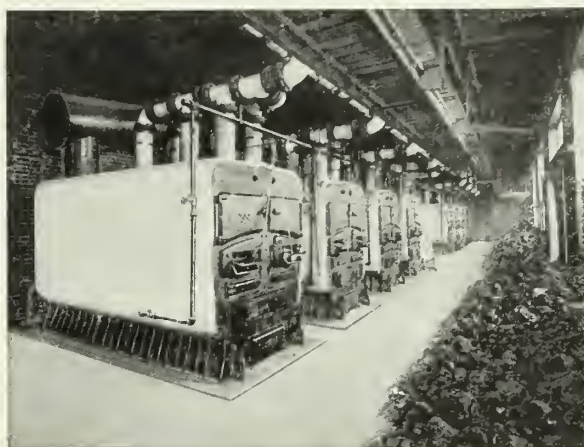
DULUTH . . . MINNESOTA



Section to show long circulation path

Smokeless heating boilers which burn cheap soft coal

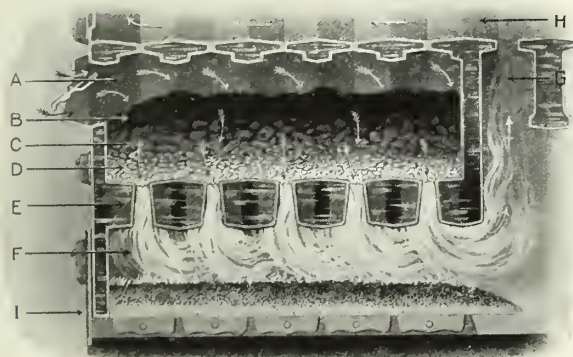
For factories, warehouses, hotels, etc., in districts where soft coals are plentiful and low in price IDEAL Smokeless Down-Draft Boilers will prove a big factor in cutting down overhead expenses.



Battery of eight IDEAL Smokeless Down-Draft Soft Coal Boilers in Curtiss Aeroplane Factory at Buffalo. Self-contained; no brick-setting. Burns soft coal without smoke.

IDEAL Smokeless Down-Draft Boilers

Save on the coal bill and give plenty of heat



Cut-away view of the side of an IDEAL Smokeless Down-Draft Boiler, showing ample gas-spaces through the water grate, and the processes of smokeless combustion of soft coal between the double grates.

are made of everlasting cast-iron, outwear steel boilers many years. Meet all requirements of smoke ordinances. Easy to run and clean. Tested in the leading soft coal markets for past five years and approved by all Smoke Inspectors.

Ask for catalog "Ideal Smokeless Down-Draft Boilers"—and let us refer you to present installations of these famous boilers—to know first-hand about their cleanliness and economy.

AMERICAN RADIATOR COMPANY

Sales branches and showrooms in all the large cities

SPECIFICATIONS

All ventilators to be of the Rotary Ball Bearing type, {Glass top } of {galvanized } rust-resisting metal, all interior members of angle iron, hot galvanized after forming and punching. The ventilators to turn sensitively on accurately machined bronze bearings, employing bell metal balls, and counter-weighted on outside. The ventilators to be equipped with outside louver dampers to throw accumulated dirt outside of building, louver to be operated from within by brass chains over brass pulleys. Gauge of metal* to be The Ohio Blower Co., Cleveland, Ohio, Standard, as furnished in Swartwout Rotary Ball-Bearing Ventilators at regular prices. Top of collar and bottom of hood to be stiffened with galvanized angle iron rings.**

*If desired, give standard gauge as shown in table of dimensions on Standard Ventilation Data Card, Sweet's Catalog or our Catalog—"The Gospel of Fresh Air."

**Follow with specifications for base—(see Data Card, "Sweet's," or catalog).

*Front View
Swartwout Rotary
Ball-Bearing
Ventilator, glass top
type, with type of base
recommended*

Write for Ventilation Data Card giving ventilator and base specifications as described at right

The Ohio Blower Company
9229 Detroit Ave., Cleveland, Ohio

Branch Offices and agencies in principal cities from coast to coast

VENTILATION

TO INSURE FRESH AIR to the structures you design there is no surer or more economical method than to specify

SWARTWOUT
ROTARY BALL-BEARING
VENTILATORS

Patented

Write for Data Card.

An 8½ x 11 in. card, giving fresh air requirements, table of capacities, ventilator and base specifications, etc., in quick reference form. In writing for Data Card kindly use professional letterhead.

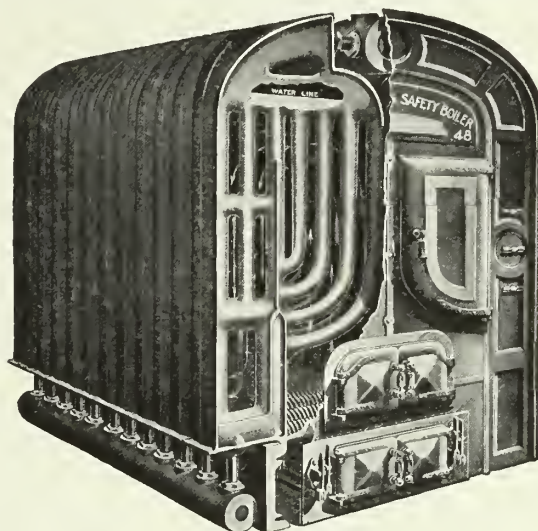


When You Consider the Heating Boiler—

You want to know the one that will be of greatest efficiency at that rate of combustion which will give satisfactory service *the greater part of the time*. It is not safe to specify grate area, for not all boilers of the same grate area will supply the same amount of steam at the radiators, nor will all be of the highest efficiency.

The character and location of fire surface, rate of fire surface to grate area, and details of construction are important.

Coöperating with heating engineers, you will find the tables relating to



RADIATION, EFFICIENCY AND RATE OF COMBUSTION
No. 48 MILLS BOILER. From performance tests

Sections	7		8		9		10		11		12	
Steam Radiation Carried	Efficiency	Rate of Comb.	Efficiency	Rate of Comb.	Efficiency	Rate of Comb.	Efficiency	Rate of Comb.	Efficiency	Rate of Comb.	Efficiency	Rate of Comb.
1000	62.0	3.1	61.0	2.7	60.0	2.3	59.0	2.1	58.0	1.9	57.0	1.7
2000	67.5	5.7	66.0	4.9	65.0	4.3	64.0	3.8	62.5	3.4	61.5	3.2
3000	71.0	8.2	70.5	6.9	69.5	6.0	68.5	5.3	67.5	4.8	66.5	4.4
4000	71.0	10.9	72.5	8.9	72.5	7.6	72.0	6.8	71.5	6.1	71.0	5.5
5000	67.5	14.4	69.5	11.7	72.5	9.6	73.5	8.3	74.0	7.3	74.0	6.6
6000	62.5	18.6	64.5	15.1	68.0	12.2	71.0	10.3	72.5	8.9	74.5	7.8
7000	..	..	59.0	19.2	62.5	15.5	65.5	13.0	67.5	11.2	70.5	9.7
8000	..	..	..	..	..	..	59.0	16.4	61.5	14.0	65.0	12.0
9000	..	..	..	..	..	..	..	..	..	..	59.0	14.8
	13		14		15		16		17		18	
2000	60.5	2.9	58.5	2.8	..	..	..	..	..	..	..	..
3000	65.5	4.0	63.5	3.8	61.5	3.6	59.5	3.5	..	..	..	..
4000	70.0	5.0	68.0	4.8	66.5	4.5	64.5	4.3	62.5	5.2	60.5	4.9
5000	74.0	6.0	72.5	5.6	70.5	5.3	69.0	5.0	67.5	6.0	65.5	5.7
6000	76.0	7.0	75.5	6.4	74.0	6.1	72.5	5.8	71.5	6.8	70.0	6.4
7000	73.0	8.5	75.5	7.5	76.5	6.8	75.5	6.4	75.0	7.5	74.0	7.1
8000	69.0	10.2	72.5	8.9	75.5	7.9	77.0	7.2	77.0	8.4	77.0	7.8
9000	64.5	12.3	68.5	10.6	72.0	9.3	75.0	8.3	77.0	9.5	77.5	8.7
10000	60.0	14.7	64.0	12.6	68.0	11.0	71.5	9.3	74.0	10.9	76.5	9.8
11000	..	..	59.5	15.0	64.0	12.8	68.0	11.2	71.0	12.5	74.0	11.1
12000	..	..	..	..	59.5	15.1	64.5	12.9	68.0	14.3	71.5	12.5
13000	..	..	..	..	..	..	61.0	14.8	64.5	16.3	68.5	14.2
14000	..	..	..	..	..	..	..	..	61.5	18.4	65.0	16.1
15000	..	..	..	..	..	..	..	..	..	..	61.0	18.4

Mills Water Tube Boiler

of great assistance. They enable you to determine the number of sections and the efficiency at various rates of combustion.

Size of boiler and grate area are not the important factors, for a boiler of the Mills design will supply the steam or hot water even though smaller than some other makes. Tables on all sizes of the Mills Boilers should be in the hands of the architect.

THE H. B. SMITH COMPANY
WESTFIELD, MASS.

NEW YORK
10 East 39th Street

PHILADELPHIA
1225 Arch Street

BOSTON
138 Washington Street No.

56-56

Mr. Architect and Master Builder:

In creating modern buildings first consideration is given the requirements for safety of life and of the owner's investment. Architectural beauty is considered as much as ever, only nowadays it does not transcend the practical.

Fire is the greatest menace to safety of life and investments. Therefore the essentials of safety from fire are fundamental in building creation.

AUTOMATIC SPRINKLERS

Provide essentials of safety from fire. Also provide many economic benefits
They—

SAFEGUARD LIFE

"The automatic sprinkler affords the largest degree of protection of life against fire."—*The National Fire Protection Association's Safety to Life Committee.*

Not a life lost in more than 20,000 fires in sprinkler-equipped buildings under conditions such as obtained in the Triangle and Diamond factory fires where 160 lives were lost!

"Loss of life would not have occurred had the Triangle building been equipped with automatic sprinklers."—*Opinion of New York Fire Department.*

More than 3,000,000 persons work daily under constant protection from fire by automatic sprinklers in factories and shops in North America. The 3,000 pictured at the right do.



MAKE BUILDINGS FULLY FIRE-RESISTANT

"Fireproof" buildings are proof against fire in that the materials of construction are incombustible and will not burn, but this physical property does not impart to the contents of buildings any mysterious power to resist fire.

The Triangle factory fire happened in a "fireproof" building. It effectually exploded the delusion that a "fireproof" building is a sufficient assurance of safety, and showed that such a building is as a stove in which the contents are fuel and human beings potential cinders!

Incombustible materials of construction offer passive resistance to fire while automatic sprinklers in discharging water when actuated by fire offer active resistance and, in consequence, protection to contents.

MAKE SAFETY PAY DIVIDENDS; BETTER BUSINESS

Automatic sprinklers reduce insurance cost from 40 to 90 per cent, according to construction, occupancy and location of buildings. In the average "fireproof" loft building in New York the reduction is 85 per cent. The announcement pictured at the right was in a grade-story show window of such a building.

Moreover investments in sprinkler protection hold the record for brief periods of amortization and thereafter increase profits as much as 20 per cent.

"Sprinklers are practically an insurance against vacant lofts; the unsprinklered building cannot compete with the sprinklered building for tenants," says a big New York renting agency. "We do not know of any investment that will yield the owner greater dividends in economies."



CONSERVE CONSTRUCTION AND DECORATION ESTHETICS

Architects sometimes object to automatic sprinklers because the exposed piping of ordinary systems does not always harmonize with the esthetics of interior construction and decoration.

But this difficulty is easily overcome. Supply pipes can be concealed in construction work and sprinkler heads arranged so that they just protrude through the ceiling and ornamental devices serve to harmonize them with decorative schemes.

How inconspicuous is a concealed sprinkler system is illustrated in the picture at the left, a view of the principal's office in a completely sprinklered private school—only the sprinklers are visible.

INFORMATION SERVICE DEPARTMENT

NATIONAL AUTOMATIC SPRINKLER ASSOCIATION

80 Maiden Lane, New York, N. Y.

Potential Power of Architects to Create Conditions Favoring Conservation

CONSERVATION now consumes the attention of the public—there is grave need of conservation of the food supply—feeding is as necessary as fighting to win the war.

Much food has been wasted by both feasting and fire. Mr. Hoover tells how to conserve the food supply by regulating consumption.

The National Board of Fire Underwriters (New York) tells how to conserve food and other things from waste by fire in "Safeguarding Industry—A War-Time Necessity," a book of common-sense rules for remedying conditions favoring the inception and spread of fire. The book is valuable to architects. A mere request will get a copy.

Six conditions favor inception and spread of fire, says the book:

- (1) Disorder; (2) Ignorance and Carelessness; (3) Defective Equipment;
- (4) Faulty Construction; (5) Insufficient Protection; and (6) Lack of Defense.

Architects are mainly responsible for conditions three, four, and five. Though only half the number, they comprehend many more factors of safety than the others. Therefore the potential power of architects to create conditions favoring conservation.

The most vital condition concerns the control of fire. The book says:

Common sense will tell you that almost all fires have small beginnings, from which arises the old saying that the first five minutes in fighting a fire is worth more than the next five hours. This means that your means of extinguishing should be immediately accessible, in other words, that such means should be distributed throughout your premises so that at no point will they be far away. The most valuable of all devices for this purpose is the automatic sprinkler, which is too familiar to need description. It provides an immediate downpour of water at the exact place of the blaze, and generally extinguishes such a blaze at once. Insurance companies recognize this protection by making a large reduction in rates wherever buildings are well equipped with sprinklers.

Among "Practical Suggestions for Reducing Fire Loss" is this:

When properly installed, with an abundant and constant water supply at proper pressure, and the equipment maintained in a constantly operative condition, the automatic sprinkler has proven itself to be the most reliable and satisfactory fire extinguishing device in use, being suitable for effective service in practically every class of structure and under nearly any condition of fire hazard arising from causes incident to occupancy or processes. It is therefore urged that such protection be installed in every structure where the nature of the occupancy is not such as to render these devices inoperative or ineffective.

Today the design and equipment of buildings to resist and control fire is not only a practical necessity, but also a war-time necessity, and above all, A PATRIOTIC DUTY!

ARCHITECTS SHOULD EXERCISE THEIR POTENTIAL POWER NOW!

Information Service Department

National Automatic Sprinkler Association

80 MAIDEN LANE, NEW YORK, N. Y.

“Get” the Fire or Get Away from It?

Which is the Fundamental Principle of Safety?

GETTING away from fires, rather than “getting” fires before they get away, would seem to be regarded as the fundamental principle of safety from fire in the usual run of laws enacted to provide for this safety. The nature of these laws implies the expectancy that once a fire begins it inevitably progresses to a disastrous finish, for the laws provide mainly for means of getting out of buildings (exits) and give little, if any, consideration to getting control of fire before it gets out of hand.

Whereas, to “get” the fire before it gets away is the fundamental principle of safety from fire!

SAFETY POSSIBLE INSIDE BUILDINGS

Safety laws virtually say this to those in whose interests they are enacted: “You cannot be safe from fire in any building; the only place of safety is outside buildings. The laws provide for exits whereby you may reach safety, and it is up to you to use this means of assuring your own safety.”

EXIT REQUIREMENTS SHIFT RESPONSIBILITY

Really, in this respect, laws shift responsibility of assuring absolute safety from fire from where it rightfully belongs to the shoulders of those whom the laws are intended to protect. Those who are responsible for conditions of safety may well argue that in providing exits they have done all that is required of them, and ignore altogether the need of doing what is necessary to provide for the control of fire where it originates—the fundamental requirement for safety from fire.

CONTROL FIRE WHERE IT ORIGINATES

Fire is controlled where it originates by water discharged from automatic sprinklers opened by the heat of the fire in about the same time as it takes to remark this fact.

Automatic sprinklers, according to the authoritative records of the National Fire Protection Association, have controlled, where they originated, 95.47 per cent of 18,795 fires during a period of twenty years.

SPRINKLER PROTECTION MOST EFFICIENT WHERE LIFE-HAZARD GREATEST!

But where life has been most seriously hazarded, sprinkler protection has been most effective! Sprinklers successfully controlled 98.1 per cent of 10,285 fires in fifty classes of property where life was most seriously hazarded—2.63 per cent better than the general average!

And in these fifty classes (36 per cent of total number listed) were 60 per cent of all the fires!

Which is quite sufficient justification for the National Fire Protection Association's Life Safety Committee's estimate of the value of automatic sprinkler protection as an assurance of safety to life from the hazard of fire:

“It is today an almost unquestioned fact that the automatic sprinkler affords the largest degree of protection of life against fire. The immense number of fires which have either been promptly extinguished or held in check by the quick operation of the automatic sprinkler definitely demonstrates this when the record is compared with similar fires starting in buildings which had no sprinkler protection and in which large loss of life has resulted.”

And mark this. All of the hue and cry over exits is because of the loss of life in fires in buildings not equipped with sprinklers. In nearly 19,000 fires in sprinklered properties not a single life has been lost under such circumstances as obtained in the fearful holocausts in the Triangle waist factory in New York, the overall factory in Binghamton, and the Diamond candy factory in Brooklyn.

*Automatic Sprinklers “Get” the Fire Before It Gets Away—
The Fundamental Principle of Safety from Fire*

Information Service Department

National Automatic Sprinkler Association

80 MAIDEN LANE, NEW YORK, N. Y.

Why Gild "Fireproof?"

"Fireproof," popular fancy synonymizes with safety from fire; invests incombustible materials of construction with mysterious power to impart their characteristics of fire resistance to completed and occupied "fireproof" buildings.

"It's absolutely fireproof; it cannot burn," is the familiar chatter of the owner of a "fireproof" building containing enough fuel in combustible contents to steam a mammoth ocean liner several days.

The Triangle Waist Factory fire which took a fearful toll of human life in a "fireproof" building, and the Edison Works fire which blazed unrestrained through nine "fireproof" buildings in seven hours, completely gutting them, are sufficient examples of the fact that it is

not the function of a "fireproof" building to safeguard contents

The merits of "fireproof" construction are beyond question, but whatever these merits they cannot comprehend incombustible building materials as a sufficient assurance of safety from fire in an occupied "fireproof" building.

"Maximum fire protection," a manufacturer of an incombustible building material announced, would be assured by the use of it. How so, when maximum protection against fire comprehends not only the incombustion of construction materials but also active control of fire, and all that can be expected of incombustible construction materials is passive resistance? They cannot, by any stretch of fancy, be considered as having any effect whatever on the burning of combustible contents.

Complete Fire Resistance

is made possible by automatic sprinklers. The fire-activated automatic discharge of water right where it is needed most, in the heart of a fire, not only actively resists the flames in combustible contents but also fortifies the passive resistance of the materials of construction.

Last fall, in a New York suburb, a seven-story "fireproof" storage warehouse experienced a fire which is comprehensively epitomized in this conclusion in a report prepared by Ira H. Woolson, consulting engineer to the committee on construction of buildings, National Board of Fire Underwriters:

"The one fact which stands out above all others in connection with this fire is that a suitable sprinkler system would have saved the concrete building with its contents and probably have controlled the fire in the frame building. It is one more demonstration of the folly of depending upon fire-resistive construction alone to protect inflammable contents of a building from fire. The owners had evidently made sincere efforts to have a very safe structure. It was in general well built; wired glass windows were provided on all sides; the protection of vertical openings was standard; double approved fire doors were provided on communicating doorways; sets of fire pails properly filled were scattered about each floor, but were useless because of the smoke which entered the building preceding the fire. With all these precautions the building is today badly wrecked; a large proportion of the contents is ruined either by fire or water, and a total property loss of \$125,000 or more has been sustained. Only a portion of this is covered by insurance and the business of the owners will be more or less paralyzed for many months. All this could have been saved by a comparatively small investment in sprinkler protection."

A "FIREPROOF" BUILDING IS—COMPLETELY—WHEN SPRINKLERED

Information Service Department

National Automatic Sprinkler Association

80 MAIDEN LANE, NEW YORK, N. Y.



DOORWAY
THE STEARNS HOUSE
at Bedford, Mass.
Built in 1802.
Reuben Duren, Architect.

The front elevation of this house was shown in Vol. I, No. 2 of the White Pine Monographs.

THREE essentials for success in home-building are—a practical plan, artistic design and good workmanship.

But without the fourth essential—proper selection of materials—the other three are of little avail.

Take the matter of lumber. All woods are not equally good for all uses. One is good for one purpose—another for another. Select woods for their proper uses, and you will have no disappointments.

WHITE PINE

For the outer covering of a house—subjected to the rigorous onslaught of rain and snow, heat and cold, sun and wind—no other wood is so durable and holds its place so well, without warping, splitting, rotting, or opening at the joints, as White Pine.

*Address WHITE PINE BUREAU,
2144 Merchants Bank Building, St. Paul, Minn.*

Representing
The Northern Pine Manufacturers'
Association of Minnesota, Wisconsin
and Michigan, and the Associated
White Pine Manufacturers of Idaho

OAK

The Wood Used from Time Immemorial

UNIVERSALITY

Oak has been regarded as the king of the forest from the earliest days. Its manufacture into lumber was a pioneer phase of the hardwood industry of the country. By reason of respectful familiarity there is an inbred accuracy in handling Oak among those who work in woods.

Oak is strong, tough, enduring and beautiful. Its application to all forms of building construction, adornment, and equipment is practically without limitation—so infinite are its possibilities.

CHARACTERISTICS AND EFFECTS

The Oaks in this country are commercially divided into two varieties—the White Oak and the Red Oak. In height they range from 60 to 100 feet, and in diameter from 1 to 6 feet. The growth is from southern Maine and southwestern Quebec to central and southern Ontario, the lower Peninsula of Michigan, southern Wisconsin and southern Minnesota, and to southern Nebraska and Kansas, southern and northern Florida and Texas, and to the Gulf. The leaves of nearly all varieties of White Oak have rounded lobes while those of the Red Oak are invariably pointed. The bark of the White Oak is also an aid in identification, as from its whiteness it gained its name. The medullary rays of no wood in the world are more utilized to commercial advantage than those of the Oak. Quartersawing is for the purpose of bringing them out and producing the beautiful figured effect so much admired by all. They are the bright streaks, clearly visible to the naked eye, in the end of an Oak log, radiating from the center outward like the spokes of a wheel. By quartersawing, the rays are cut edgewise and appear as bright streaks or flakes, often called mirrors, on the surface of the board.

IN HOME-BUILDING

In its charming simplicity, Oak will be in style and good taste for all time to come, and its choice for interior finish, paneling trim, doors, furniture, and floors insures the quality that gives a friendly atmosphere to the home.

IN PUBLIC BUILDINGS

Oak doors and interior trim for public buildings are desired, not only because of Oak's historic excellence as a cabinet wood and its inborn trait of "staying put," but also because by its use the best results may be obtained without the experimentation required with woods less thoroughly standardized. There is no other wood which will better withstand the very hard usage to which doors, interior trim, flooring, paneling and furniture are put to in public buildings.

THE OAK MANUFACTURERS' ASSOCIATION

From the felling of the trees in the forest and the selection of logs by size and quality, the manufacturers of Oak lumber are now enabled to take the fullest advantage, by coöperative work, of the experience gained through long years of training. With mechanical appliances of the very best type for specified methods of sawing—by piling and seasoning according to the best established practice—and through following approved standards of inspection and grading, the manufacturers of Oak lumber are able to offer a product and assure a service in accordance with the highest state of the art in the growth and uses of Oak.

We have now in preparation a booklet about Oak which will shortly be ready for distribution. It, and the service of the Association, are at the command of those desiring information pertaining to this premier hardwood.

The American Oak Manufacturers' Association

Bank of Commerce & Trust Building

MEMPHIS, TENN.



These two photographs show the rapid progress made in the construction of the pattern shop of the Allis-Chalmers Manufacturing Company. No Time Lost Here Waiting for Delayed Material. One Million Feet of Southern Yellow Pine Used.

Yes Sir! Mill Construction!

Would you build—**now**—a new Shop, Factory, Foundry, Mill, Warehouse? What is your chance to obtain structural material promptly—**NOW**?

The time-saving, money-saving, trouble-saving course open to you is to erect the Standard Mill-Construction type of building—employing, for interior framing and floors, sturdy, durable, dependable

Southern Yellow Pine

Unlimited quantities of highest grade Southern Yellow Pine, in all its forms, are available **now**, including heart timbers meeting completely every requirement of the Density Rule, formulated by the U. S. Forest Service and adopted as standard by the Southern Pine Association, the Society For Testing Materials, and the United States Navy Department.

Standard Mill-Construction, employing Southern Yellow Pine, is the most ECONOMICAL as well as the most SERVICEABLE type of industrial structure. Properly sprinklered, a mill-constructed building is rated far more fire safe than a non-sprinklered building of so-called "fire-proof" type.

Our new book, "Mill-Construction," an authoritative and comprehensive work on modern building, is ready for distribution. A copy will be sent you, gratis, promptly on request.

Southern Pine Association

2092 Interstate Bank Bldg.,

New Orleans, Louisiana

RED GUM *"The wood unsurpassed for Interior Finish"*

Characteristics, uses and effects:

Commercially the term "red gum" applies to the heart wood of the red gum tree. In Europe this wood is known as red gum, satin walnut and hazelwood. Unselected gum, or sap gum, may be partially heart wood and partially sap wood or all sap wood. Red gum is furnished in either plain or quarter-sawed lumber and veneer, as is the unselected, or sap gum. Red gum selected for figure can also be supplied in both lumber and veneer.

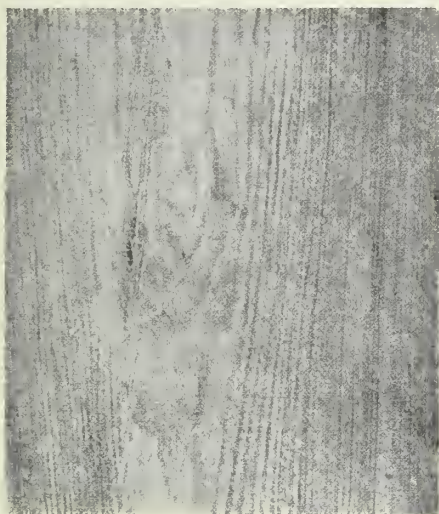
Gumwood is adaptable to a great variety of uses including the best grades of the richest colored and highly figured panels used in artistic architectural woodwork of all kinds. The effects that can

be obtained by staining are varied and unusually attractive.

Red Gum has become a leading cabinet wood because of its beauty, adaptability and fine workable qualities. Selections of lumber or veneer may be made to meet special requirements, either of highly figured wood or plain wood, quarter-sawed or plain sawed. Veneer is also manufactured in sliced and rotary cut.

Below see illustrations of two pieces cut from Gum Wood showing the range from the simplest plain-sawed plain wood to the quarter-sawed figured wood, the latter a veneer. Between these there are many variations, as explained and illustrated in "Technical Information about Red Gum."

"America's Finest Cabinet Wood"



No. 2

No. 2—Shows plain sawed Red Gum, plain wood (commonly termed Plain Red Gum, but when plain-sawed plain wood is desired it should be specified as "Plain Sawed Red Gum, plain wood"). This is a fine example as it runs by the car load. However, not all plain sawed Red Gum, plain wood, is perfectly plain, as most Red Gum shows some stripe effects and color tones. Its character is soft and delicate, and finished natural or stained, is very pleasing and attractive. Millions of feet are used, both in this country and abroad, for interior finish, furniture, etc.



No. 7

No. 7—A panel of quarter-sawed Red Gum veneer, figured wood, matched. All Red Gum, whether figured wood or plain wood, quarter-sawed or plain sawed, has a rich, reddish-brown color, with a character as soft and delicate as the sheen of fine satin, and quarter-sawed figured Red Gum veneer offers possibilities for matching figure known to no other wood. It produces a great variety of markings and color tones, and selections of flitches may be made to meet the individual taste of the designer. It has the combined beauty of Circassian Walnut and Mahogany, yet has a distinctive character peculiar to no other wood.

The Gum Lumber Manufacturers' Association was organized three years ago with headquarters at Memphis, Tenn. The Association now has a membership composed of one hundred and thirty of the leading gum manufacturers. It has become a power which has lifted gum to a leading place among the cabinet woods.

The Gum Lumber Manufacturers' Association has carried on a scientific study of the best methods of manufacturing, caring for and kiln-drying gum lumber.

During the last three years, since the Gum Lumber Manufacturers' Association began a general publicity campaign in behalf of red gum, its use has increased more than one hundred per cent, in our domestic markets, and at the present time it is giving universal satisfaction. This is due entirely to a thorough understanding of the wood, which begins with the progressive lumber manufacturer, includes the appreciative discernment of the architect and ends with the gratified client.

Publications:—The Association has prepared and will gladly send to Architects and other readers of *The Journal*, either or both of its Booklets, entitled: "Red Gum Facts," "Technical Information about Red Gum," which are referred to under sub-divisions in this issue.

It offers its facilities and service, and samples when desired, to all those desiring the fullest information, facts and recommendations pertaining to the use of Gumwood where its use is best, whether in large work or small.

GUM LUMBER MANUFACTURERS' ASSOCIATION

1339-44 Bank of Commerce and Trust Building

-

MEMPHIS, TENN.

Murphy Varnish Company

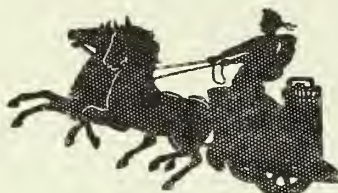
Chestnut and McWhorter Streets
NEWARK, N. J.

50 West 22nd Street
CHICAGO, ILL.

THE DOUGALL VARNISH COMPANY, LIMITED, MONTREAL, CANADIAN ASSOCIATE

Products.

MURPHY TRANSPARENT INTERIOR VARNISH.
MURPHY NOGLOSS INTERIOR VARNISH.
MURPHY SEMI-GLOSS INTERIOR VARNISH.
MURPHY TRANSPARENT FLOOR VARNISH.
MURPHY VELVET FLOOR VARNISH.
MURPHY TRANSPARENT SPAR VARNISH.
MURPHY UNIVERNISH.
MURPHY WHITE ENAMEL.
MURPHY SEMI-GLOSS ENAMEL.
MURPHY ENAMEL UNDERCOATING.
MURPHY KONKRETO.



TRADE SYMBOL

whenever required, without removing the original coat. Stands the wear of passing feet; is not affected by heavy furniture rolled over it and is, besides, the most enduring of floor varnishes. Used in thousands of fine homes, hotels, office buildings, etc. \$4 a gallon.

MURPHY VELVET FLOOR FINISH—For final coats only over Transparent Floor Varnish when a semi-gloss finish is desired. Has the effect of wax without the slipperiness, and requires no rubbing. \$4 a gallon.

MURPHY TRANSPARENT SPAR VARNISH—A fine durable outdoor varnish for all outside work except floors. It is moistureproof, endures heat and cold, and resists grit and smut as long as any varnish possibly can. It lasts a long time and remains attractive as long as it lasts. \$5 a gallon.

MURPHY UNIVERNISH—A varnish for many uses—for inside and outside work and for floors. Proof against hot or cold water, steam, hot dishes, alkali, alcohol, ammonia, etc. Nothing turns it white. For these reasons, it is a particularly good varnish for places which are unduly exposed to rough use.

While the name suggests its all-round use where these qualities are desired, it is not, and no one varnish can be, the best varnish for every technical purpose. Univernish does, however, approximate the good qualities of many fine varnishes and may be relied upon for elegant finish and durability.

Murphy Univernish stands the extremes of weather wonderfully, does not thicken in the can, nor clog the painter's brush; it works easily and flows out smooth. Do not apply Univernish over shellac or liquid fillers. \$4.50 a gallon.

MURPHY WHITE ENAMEL—A pure white enamel of the finest grade and long life. It can be used either indoors or outdoors—dries hard for indoors and wears wonderfully well for outdoors. Can be tinted, of course. \$6.50 a gallon.

MURPHY SEMI-GLOSS ENAMEL—As a final coat over Murphy White Enamel it produces a beautiful semi-gloss effect without the expense of rubbing. \$6.50 a gallon.

MURPHY ENAMEL UNDERCOATING—Dense covering, flat drying. Is used for foundation coats for Murphy White Enamel. Much more suitable for this work than lead-and-oil. If colored enamel surface is wanted, the second and succeeding coats should be colored to match the enamel. \$4 a gallon.

MURPHY KONKRETO—For the sanitary treatment of concrete or cement floors, walls, or ceiling. Gives smooth surface. Prevents them from wearing, dusting and getting mouldy. Makes them as easy to clean and keep clean as tiling. \$4.50 a gallon.

Scope.

The MURPHY VARNISH COMPANY has been in existence over half a century. It supplies most of the railways, the manufacturers of fine furniture, pianos, automobiles, and the other large consumers who are experts in the use of varnish. We make over 200 kinds of varnish—it being true to-day, as it always has been, that no one varnish can be used for all purposes.

Architectural Varnishes.

The varnishes and enamels described below are those which time and experience have proven best for fine architectural work.

MURPHY TRANSPARENT INTERIOR VARNISH—A fine transparent lustrous varnish which brings out the grain of the wood, flows freely, covers a great deal of surface, rubs easily, and keeps its full beauty for many years. Used extensively in fine residences, hotels, public buildings, office buildings and wherever fine woodwork needs to be beautified, protected and made sanitary. \$4 a gallon.

MURPHY NOGLOSS INTERIOR VARNISH—This varnish, used for the final coat over Murphy Transparent Interior, gives a rubbed effect without the labor of rubbing. Beautifully shows the grain of the wood. Can be used alone by applying the proper number of coats. \$4 a gallon.

MURPHY SEMI-GLOSS INTERIOR VARNISH—As the name implies, it is half way between the Nogloss rubbed effect and the Transparent Interior (unrubbed) and gives a slightly rubbed appearance. \$4 a gallon.

MURPHY TRANSPARENT FLOOR VARNISH—A fine free-flowing varnish that rubs easily, producing a very smooth, beautiful surface. Does not flake off; is not affected by reasonable exposure to moisture, air, or water. It can be covered year after year with a new coat,

Book on Varnish and Enamel.

We will furnish any architect, on request, our book on Architectural Varnishes and Enamel, and place him on our lists to receive bulletins and such other literature as we may prepare from time to time.

Free Educational Murphy Books.

Rare woods. Eight and one-half by eleven inches in size. An artistic and useful repository of rare wood finishes.

Architectural Varnishes and Enamels. Pocket edition, alike helpful to architects, painters and owners.

Beautiful Floors and How to Care for Them.

The House That Found Itself. An illustrated story of how a house was made into a home.

Beautiful Boats and How to Care for Them. A handsome book illustrated in color indicating the uses of Murphy Transparent Spar Varnish—the brineproof varnish.

Murphy Linoleum Varnish.

Murphy Finishing System for Carriages and Motor Cars.

Pure Colors Ground in Oil.

Specification Guide for Varnish and Enamel.

Below is a convenient reference guide to specifications for varnish and enamel. To any architect who desires a copy of these specifications we shall be glad to send them.

We urge that not only the maker be named, but the particular kind of varnish desired. It is not sufficient, for example, to say "Murphy Varnish." We make many grades, each one the best for its special purpose, but no one the best for every purpose.

We do not recommend the phrase "or equal" in any specification. It results in the use of inferior varnish. We believe that the clients' interest, your own, and each bidder's interest will be better served by specifying directly what you want, whether it is Murphy Varnish or some other make.

The slight difference in cost between good varnish and poor varnish is more than offset by the longer life of good varnish, by its saving of labor in application and the greater area covered, and a skillful painter, estimating on a definite basis, will always want the quality varnish.

Specifications for Wood Finishing

MATERIALS—All materials shall be of the manufacture of the MURPHY VARNISH COMPANY and delivered at the mill or building in the original containers for inspection by the architect.

PREPARATION—All woodwork shall be thoroughly dry and all stains, finger marks or other blemishes carefully removed before any finish is applied.

BACK PRIMING—All back surfaces of woodwork shall be primed at the mill with 1 coat of paint, consisting of 15 lbs. of pure red lead to 1 gal. of pure boiled linseed oil, well brushed out.

INTERIOR NATURAL FINISH—All *oak (or other open grain woods)* finishing woodwork shall be prepared for varnishing

with a coat of Murphy Filler No. . . . , well wiped off the surface.

NOTE—All open grain woods should have the pores filled, in order to present a smooth surface for varnishing, unless an open pore effect is especially desired.

All *birch (or other close grain woods)* finishing woodwork shall be prepared for varnishing with a coat of Murphy Shellacquer, white or orange as the case may require.

NOTE—All close grain woods are thinly shellacked to prevent undue absorption or sinking. Fillers should not be used on close grain woods.

(A) *Rubbed Finish*—All *oak* finishing woodwork shall be given 3 coats and *birch* 2 coats of Murphy Transparent Interior Varnish, allowing ample time for drying between coats. Undercoats shall be lightly sandpapered and final coat, except in service portions of house, shall be rubbed down with pumice and water, and then with oil.

NOTE—Woods in italics are variable. The *birch* or other close grain wood is given only 2 coats of varnish, because the Shellacquer is the equivalent of a third. A flowed-on gloss finish is the more practicable for the service portions of the house, and naturally more economical.

(B) *Rubbed Effect, Dull*—All *oak* finishing woodwork shall be given 3 coats and *birch* 2 coats of Murphy Nogloss Interior Varnish, allowing ample time for drying between coats. Undercoats shall be lightly sandpapered and final coat flowed on.

(C) *Rubbed Effect, Semi-gloss*—All *oak* finishing woodwork shall be given 3 coats and *birch* 2 coats of Murphy Semi-gloss Interior Varnish, allowing ample time for drying between coats. Undercoats shall be lightly sandpapered and final coat flowed on.

NOTE—A, B and C are alternatives. B and C give a rubbed effect without any rubbing.

EXTERIOR NATURAL FINISH—The *oak entrance doors and frame* shall be given a coat of Murphy Filler No. . . . , well wiped off the surface, and 3 coats of Murphy Transparent Spar Varnish.

Ample time shall be allowed for drying between coats; undercoats shall be lightly sandpapered and final coat left in the gloss.

NOTE—Parts in italics are variable. Exterior varnish is generally left in the gloss, but may be rubbed, if desired, after hardening for a week.

WOOD FLOORS—All *oak (or other open grain woods)* floors shall be prepared for varnishing with a coat of Murphy Filler No. . . . , well wiped off the surface.

(A) *Gloss Finish*—All wood floors shall be given 3 coats of Murphy Transparent Floor Varnish, allowing ample time for drying between coats. Undercoats shall be lightly sandpapered and final coat shall be left in the gloss.

NOTE—If a rubbed finish is desired, substitute for the words in italics the following:

(B) *Rubbed Finish*—Rubbed down with pumice and water and then with oil.

(C) *Rubbed Effect*—All wood floors shall be given 2 coats of Murphy Transparent Floor Varnish and 1 coat of Murphy Velvet Floor Finish, allowing ample time for drying between coats. Undercoats shall be lightly sandpapered and final coat flowed on.

NOTE—A, B and C are alternatives. C gives a rubbed effect without any rubbing.

A flowed-on gloss finish is the more practicable for the service portions of the house and naturally more economical. To a great extent, a gloss finish is used in the main portions also, as the gloss is soon toned down, due to the periodic wiping with damp cloths to remove the dust.

ENAMEL WORK—The finishing woodwork in (*state room or rooms*) shall be given 1 coat of pure white lead and linseed oil paint and 3 coats of Murphy Enamel Undercoating, each coat lightly sandpapered.

(A) *Gloss Finish*—Follow the above with 2 coats of Murphy White Enamel, flowed on evenly.

(B) *Rubbed Finish*—Follow the above with 2 coats of Murphy White Enamel, flowed on evenly, the latter coat rubbed down with pumice and water to a semi-gloss or dull finish as directed.

(C) *Rubbed Effect*—Follow the above with 1 coat of Murphy White Enamel and 1 coat of Murphy Semi-gloss Enamel, each coat flowed on evenly.

NOTE—A, B and C are alternatives. C gives a rubbed effect without rubbing.



Walls finished with Cabot's Old Virginia White. Roof stained with Cabot's Creosote Stains. J. W. O'Connor, Architect, New York

Cabot's Creosote Shingle Stains

The original and standard shingle stains. Soft, rich and transparent coloring effects, guaranteed wearing qualities, thorough preservation of the wood. The thoroughly reliable stain, proved by thirty-five years' use under all conditions.

Cabot's Old Virginia White

The Modern Architectural Outside White

The clean, brilliant "whitewash white" effect of Old Virginia White has real distinction. It is a softer and yet a brighter white than paint, and its texture and color-values are essentially different in character from the heavy, hard paint coating. This makes it especially appropriate for the modern "Colonial," because it gives the house at once the aspect of well-groomed old age—a result that it would take years to accomplish with paint.

Cabot's Old Virginia Tints

This softness and textural quality have led many of the leading architects to call for the same compound in tints, and Cabot's Old Virginia Tints are now made in a wide variety of delicate shades. The tones are almost pastel-like in quality, and the effects produced are most unique and pleasing.

Cabot's Stucco Stains

For staining and rainproofing cement buildings. Rich colorings, without gloss or shine, and with no coating to chalk or peel.

Cabot's Waterproof Brick Stains

Made in various colors, for faded, off colored or uneven brick, and colorless for waterproofing only.

Cabot's Sheathing and Deafening "Quilt"

Warmer, more permanent, and cheaper than back-plaster. The most scientific, sanitary, and perfect heat insulator and sound deadener ever made.

Conservo Wood Preservative

For preserving posts, sills, planks and all similar woodwork.

Dampproofing

An adhesive damp course for direct plastering.

Full information on request

Samuel Cabot, Inc., Manufacturing **Boston**
 1133 Broadway, New York Chemists 24 W. Kinzie Street, Chicago

L. SONNEBORN SONS, Inc. 262 Pearl St. NEW YORK

MAKERS OF

LAPIDOLITH

TRADE MARK

The Liquid Chemical Hardener for Concrete Floors

SPECIFICATIONS

Concrete Floors

Harden and dustproof all concrete floors with Lapidolith, manufactured by L. Sonneborn Sons, Inc., New York, as per the following directions:

Clean the floor of all dust, dirt, and oil. Flush on and distribute Lapidolith evenly with a long-handled white-wash brush. Allow the concrete to dry thoroughly between applications, i. e. allow several hours or longer for drying. Dilute Lapidolith with water for well-laid dense floors.

First application: 1 part Lapidolith to 2 parts water

Second application: 1 part Lapidolith to 1 part water

Third application: 2 parts Lapidolith to 1 part water

Following is a form whose chief merit is its brevity. Unless the contractor has had previous experience with Lapidolith, it is safer to include the directions as given above.

Concrete Floors

Top dressing for all concrete floors to be hardened with L. Sonneborn Sons' Lapidolith floor hardener, which is to be applied in strict accordance with the manufacturers' directions.

REMARKS

LAPIDOLITH

Lapidolith is a liquid chemical which renders concrete floors hard, dustproof, wearproof and watertight. When applied to old concrete floors, Lapidolith will prevent further dusting and disintegration.

ADVANTAGES OF LAPIDOLITH

Prevents dusting and wear of floors, because the texture of the floor, after this chemical has permeated it, is as hard as granite. Lapidolized floors take on a fine surface finish under service. After Lapidolith is used, floors will not crumble or dust, thus saving cost of expensive repairs to machinery and injury to merchandise. The labor cost of applying Lapidolith is negligible. Only unskilled labor is required, and an average man should be able to cover from 10,000 to 15,000 square feet per day with one application.

COVERING CAPACITY OF LAPIDOLITH

One gallon will cover 80 to 100 square feet with three applications. This will vary according to porosity of the cement. Three applications are sufficient to harden the ordinary floor.

TESTS OF LAPIDOLITH

Abrasion Test on Bauschinger Apparatus.—Cubes, two weeks old, treated with Lapidolith and untreated, showed the following results after 200 revolutions of the abrasion disc:

Untreated sample weighed before the test	.750 grams
After the test	.429 grams
Loss 43 per cent, or	.321 grams
Treated sample weighed before the test	.770 grams
After the test	.742 grams
Loss only 3½ per cent, or	.28 grams

Permeability Test.—Water was forced, under 30 pounds pressure, through sections of pipe, 1 in. deep and 6 ins. in diameter, filled with concrete treated with Lapidolith and untreated concrete. Concrete used was composed of 1 part

of Portland cement and 3 parts of 20-30 Ottawa sand. Figures below express in cubic centimeters the water which permeated the bodies of concrete in given times:

Time	Water permeated the Untreated Concrete	Water permeated the Lapidolized Concrete
1 minutes	1.132 cu. cm.	0.135 cu. cm.
30 minutes	0.186 cu. cm.	0.074 cu. cm.
60 minutes	0.174 cu. cm.	0.046 cu. cm.

GUARANTEE OF LAPIDOLITH

The chemical change effected by Lapidolith is guaranteed to be permanent.

CEMCOAT

The Sanitary Washable Wall Coating

SPECIFICATIONS FOR CEMCOAT

For exterior and interior walls or for floors apply two coats. Allow two days before floors are subjected to heavy wear.

How to Apply.—Clean the surface to be coated of all dirt and grease. Thoroughly stir the Cemcoat with a broad paddle, before using, so as to mix the pigment and vehicle, and do not allow any sediment to remain at the bottom of the container. Apply the Cemcoat with a flat wall-brush, working it well into the pores so as to secure an even and well-bonded coat. If any thinning is necessary, use only a little turpentine.

CEMCOAT FOR INTERIOR AND EXTERIOR USE

Cemcoat is an ideal enamel-like wall- and floor-coating, in white and colors. Absolutely free from all poisonous ingredients. It forms an even, non-porous surface which accords no lodgment for dust and cannot be injured by soap and water, or even water applied by a hose. The pigment and vehicle used in Cemcoat produce a tough wear-resistant and smooth surface to which dust and smoke will not adhere and which can easily be maintained in a perfect, sanitary condition.

Cemcoat for Interior Walls.—Not affected by extreme cold, steam or water; prevents oil-, water-, and lime-stains, and will not crack, crumble or wear off.

White Gloss Cemcoat.—Reflects all the light and disseminates it equally throughout the room. It does not turn yellow. Unlike enamel it needs no under coat, thus lessening the cost.

Covering Capacity.—One gallon of Cemcoat will cover 200 to 250 square feet of surface with two coats and requires no filler or primer.

Colors.—Made in any desired shade. The following standard colors are always in stock: Gray, red, green, stone, brown, terra-cotta, cream, white, concrete, moss-green, maroon, and black.

Cemcoat for Exterior Walls.—Used effectively on brick, tile, slate, stone, wood shingles, canvas or felt, and on plaster or concrete. It seals the pores and minute cracks on the surface, and, on account of high degree of elasticity and intense adhesion to surfaces, is not affected by expansion or contraction of building material and will not peel off or crack. Lasts indefinitely and will remain waterproof under the most trying conditions. For walls where moisture must not be allowed to penetrate, Cemcoat is the logical coating.

Cemcoat for Flooring.—When a decorative effect is desired, concrete floors may be treated with Cemcoat. It renders them not only attractive, but also free from dust and dampness.

LAPIDOLITH
TRADE MARK

Cemcoat



SOLVAY PROTECTIVE PAINTS AND DAMP-PROOF COATING



Biltmore Hotel, New York City. Steel protected by Solvay Hydraulic Paint.

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Architects

Terry & Tench Co., Inc.
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This is the type of buildings using
Solvay Paints and Damp-proofing

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SEMET-SOLVAY COMPANY

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WHETHER you design amphitheatres or bungalows, skyscrapers or dairies, bridges or residences, great factories or tiny garages, there's an "R. I. W." to safeguard the investment.

Architects are invited to avail themselves of the services of our technical staff and the facilities of our distributors.

"R. I. W." Tockolith
(Patented)

The gray Portland Cement paint, used as a priming coat on metal.

Permanently protects metal against corrosion.

Can be applied over incipient rust.

No. 112 "R. I. W." Damp-Resisting Paint

Black, water-proof, renders metal impervious to moisture, acids, alkalis or electrolysis.

Recommended as second coat over "R. I. W." Tockolith on metal not exposed continually to the action of light and to the elements.

Valuable where steel is to be imbedded in masonry.

"R. I. W." Cement Filler and Cement Floor Paint

(Patented as to Portland Cement, February 27, 1906)

A preservative and decorative treatment for concrete floors to render them wear-proof, oil-proof and water-proof. Twelve standard shades; special shades to order.

"R. I. W." Hospital and Laboratory Enamel

A hard-usage, white enamel. Water-proof, acid-proof, stain-proof, fume-proof. Will not turn color. Meets most rigid sanitary requirements.

TOCH Products do protect. They also preserve and beautify. It costs more ultimately to leave Toch Products out of a structure than to put them in.

"R. I. W." Liquid Konkerit Primer, and Liquid Konkerit

(Patented as to Portland Cement, February 27, 1906)

Cement paints for damp-proofing and beautifying brick, cement and concrete walls. Also used on interior of such walls as a decorative finish. White, also any color desired.

"R. I. W." Toxement
(Patented)

A lubricating, colloidal powder to be mixed with Portland Cement.

Reduces number of voids to the minimum.

Makes Portland Cement construction absolutely water-proof.

No. 110 "R. I. W." Damp-Resisting Paint

Black, water-proof, alkali-proof.

Excellent for backing limestone, granite, marble, etc.

Protects against chemical action and discoloration.

"R. I. W." Marine Cement

A black, water-proof composition.

Used for damp-proofing exterior foundation walls and footings.

Applied cold with brush.

Best filling for seams, water-proofing between decks, or wood sleepers laid in concrete.

Write for descriptive literature Department S.

TOCH BROTHERS

Technical and Scientific Paint Makers Since 1848

320 Fifth Avenue, New York

WORKS: New York; London, England; Toronto, Canada

Many pigments actually stimulate rust-

SOME paint ingredients speed corrosion! No single pigment or prepared paint gives fullest protection against all rust stimulating agents, and at the same time adequate resistance to paint-destroying agents that cause an early breakdown of the paint film, permitting rusting agents to attack the metal.

Utmost protection against rust and utmost durability of a protecting paint body is only obtainable by a painting process.

Patton's Ironhide is a two-paint, rust-proofing process. Both paints are inhibitive, impervious to all rusting agents. Each paint has special qualities, filling properties, adhesiveness, elasticity, resistance to abrasion and vibration and inertness to paint destroying fumes, gases, acids, etc. Each is a scientific, highly standardised paint.

In combination they provide an enduring, rust-proofing armor which maintains protection at lowest cost.

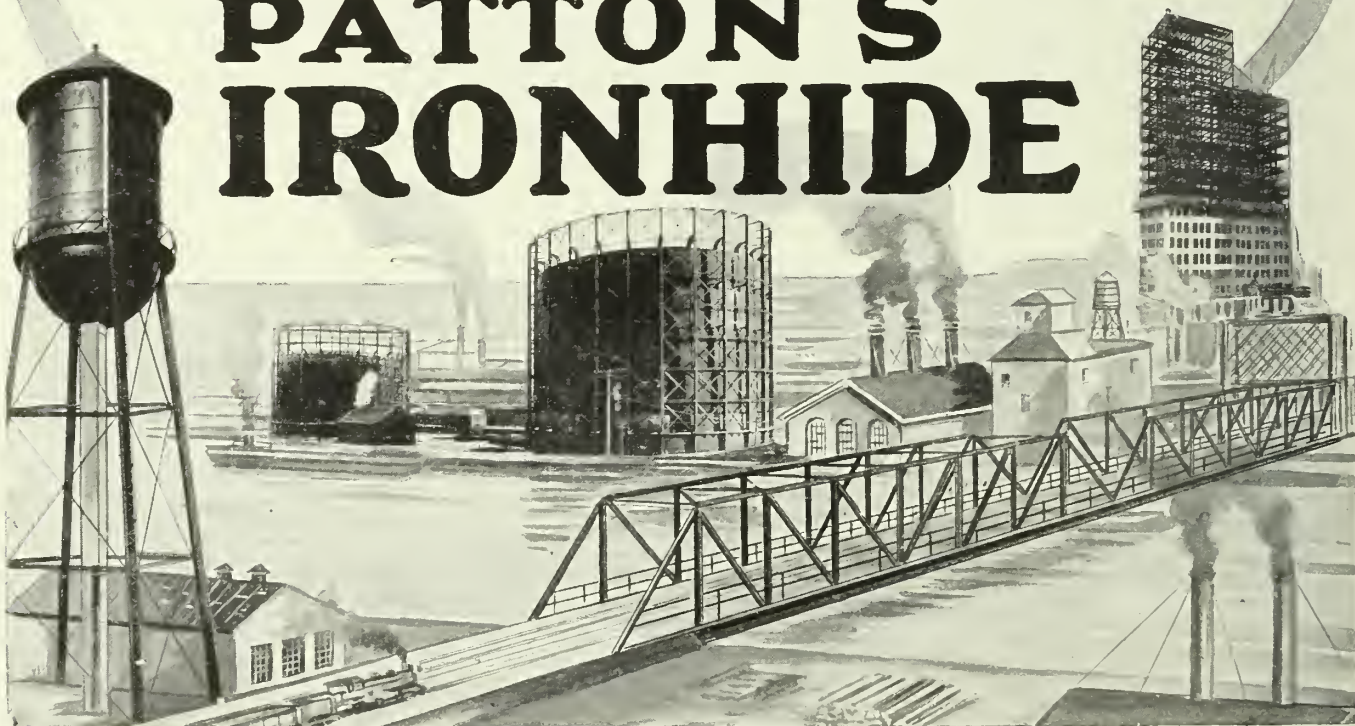


Get this book

"The Theories of Rust"—and a full description of Patton's Ironhide, the rust-proofing process. This book is worthy of your files and will command the respect of your own technical knowledge. Write for it today.

PATTON PAINT COMPANY
Milwaukee Wisconsin

-a rust-proofing PROCESS PATTON'S IRONHIDE



SPECIFICATIONS

Property of John Doe

PAINTING—All painting shall be done with



In other words, all painting shall be done with an eye to *permanent beauty*.

Matheson White Lead

and pure linseed oil form a paint that stretches and shrinks with surface changes without cracking. It endures for years, resisting all weather attacks and retaining its good looks.

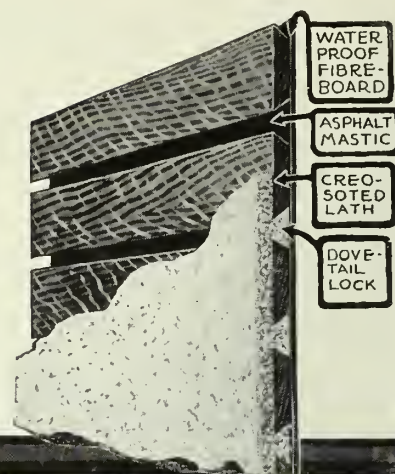
“Matheson” is especially suited for interior walls and woodwork. Any tint, texture or finish is obtainable.

MATHESON LEAD COMPANY

559-571 Vernon Avenue

Long Island City, N. Y.

A few FACTS about BISHOPRIC STUCCO BOARD



The Stucco Job that Lasts

Look at the illustration of Bishopric Board. Note how the Stucco is dovetailed into the lath. The Stucco and Bishopric Board are practically *welded together* into one solid piece. The Stucco *can't* let go—it's *clinched* to the lath. The lath are creosoted, imbedded in Asphalt Mastic on a background of heavy fibre-board. Nails through each and every lath hold the Stucco Board firmly to the frame-work.

Bishopric Board *can't sag* and crack the stucco. The fibre-board, Asphalt Mastic and creosoted lath give absolute protection against heat and cold, wind and weather. They form a construction that is waterproof, vermin-proof and sound-proof.

Bishopric Board is making Stucco finish more popular. It is providing a background that is *dependable*—that prevents unsightly cracks and breaks and that *gives added life* to the entire structure.

That is why architects, contractors, builders and owners all over the country, who take the trouble to investigate its merits, specify and use Bishopric Board.



Write for our free book, "Built on the Wisdom of Ages," illustrating homes, apartments, factory and public buildings finished in stucco on Bishopric Board. It contains letters from architects, builders and users, and extracts from reports of scientific tests. It also gives full instructions for making a stucco mixture that will last. With this book we send free samples of Bishopric Board. Write *today*, investigate for yourself, be convinced.

The Bishopric Manufacturing Co.

914 Este Ave.

Cincinnati, Ohio

Directions for Applying

Keep Bishopric Board dry, protected from rain and dampness, until ready to apply. When applied, nail thoroly as fast as put on so that rain will not twist lath strips before they are fastened. When thoroly fastened, water cannot harm them. In fact, in dry weather they should be sprinkled before applying stucco.

When fastening Bishopric Board, have lath strips cross the grain of under surface at right angles. If fastened direct to studding the lath, of course, should be horizontal. There is really no need for using seven-eighth inch sheathing, as the Stucco Board is a sheathing.

In applying Bishopric Board, *be sure to nail securely* with No. 6 galvanized wire nails, direct to the studs 16 inches apart, over sheathing on new work, or over siding on old work. This will insure the board against buckling or warping.

Bishopric Board comes in rolls four feet wide of twenty-five foot lengths each.



A Cathedral of reinforced concrete that withstands earthquake shocks

Engineering Service Extends Appreciation of Reinforced Concrete

For the past twenty years our engineers have been perfecting patented types of reinforced concrete construction to carry out their work successfully. This work has widened

the field of application until today reinforced concrete makes available the best material and type of construction for a large variety of building requirements.

This ornate cathedral with its arches and vaults is not exceptional. Perfect results are obtained here as well as in the plain manufacturing building shown below, where smooth ceilings not only eliminate corners around which fire can work, but insure speed of erection, building safety, ample light and ventilation.

It is hardly within reason to expect an architect to maintain an organization capable of handling all the details of this highly specialized work. We are therefore offering through architects an engineering service on a fee basis without obligation to use our own or any other particular products.

We are able to give patent protection on practically all types of reinforced concrete construction. We can handle work through any one of the branch offices in the different parts of the country. We can turn the force of our entire organization on one job to assist the architect to execute his commission in an unbelievably short time.

This service is carefully explained in bulletins prepared by our engineers, covering service rendered on the following kinds of buildings:

Factories	Hospitals
Warehouses	Machine Shops
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ENGINEERING SERVICE DEPARTMENT

Corrugated Bar Company, Buffalo, N. Y.

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A plain factory building of reinforced concrete

Designers and Patentees of Types of Reinforced Concrete Construction, Corr-Plate Floors and Flat Ceilings, Corrugated Bars and Corr-Mesh for scientific reinforcements

The Atlas Portland Cement Company

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PRODUCTS:

Atlas Portland Cement. A gray cement of the highest quality, strength and uniformity; tested in our own laboratories and guaranteed to more than meet all requirements of standard specifications.

Atlas-White. A true Portland Cement of the same strength, uniformity and high quality as gray Atlas, but pure white in color and absolutely non-staining; tested in our own laboratories and guaranteed to more than meet all requirements of standard specifications.

Atlas-White Mixtures. When white mortar or delicately tinted mortar is desired, white sand must be used. This is difficult to obtain in some localities. We therefore prepare three different Atlas-White mixtures consisting of Atlas-White Non-staining Portland Cement and fine white silica sand in different proportions as follows:

Atlas-White Mixture No. 1—Composed of 1 part Atlas-White and 1 part fine white silica sand.

Atlas-White Mixture No. 2—Composed of 1 part Atlas-White and 2 parts fine white silica sand.

Atlas-White Mixture No. 3—Composed of 1 part Atlas-White and 3 parts fine white silica sand.

These mixtures come to the work in bags ready to be mixed with water.

Uses of Products and Suggestions for Specifications

Atlas Portland Cement may be used for structural work, plain and reinforced, for stucco, and for all uses where a uniform high-grade Portland Cement is demanded. It more than meets the requirements of all standard specifications and, in fact, is recognized as "the standard by which all other makes are measured."

Atlas-White:

For Stucco (See modern stucco specifications in "Early Stucco Houses," and "Color Tones in Stucco" listed below under "publications.")

For setting, backing and pointing. Atlas-White Portland Cement makes ideal mortar for setting, backing and pointing all stone, marble, tile and other material where stain is to be prevented or where a white or clearly tinted mortar is desired.

How to specify mortar for backing or setting stone, marble, and other masonry:

All ——— to be set shall be thoroughly cleaned and wet down. All mortar used for setting and backing shall be composed of one part Atlas-White Portland Cement, three parts clean sharp sand [and one-tenth (or less but not exceeding one-tenth) part of hydrated lime] all measured by volume. Water and all tools used for mixing shall be absolutely clean. Mortar shall be spread to within one inch of face to allow for pointing.

No more mortar shall be mixed at one time than can be used within one hour after mixing.

How to specify mortar for pointing stone, marble and other masonry:

All joints shall be thoroughly raked out and cleaned to a depth of at least $\frac{3}{4}$ of an inch. Before actual pointing, the joint shall be washed out and thoroughly wet. All mortar used for pointing shall be composed of 1 part Atlas-White Portland Cement, and 1 part fine white silica sand (Atlas-White Mixture No. 1, may be used).

The joints shall be ——— (Here specify character of pointing, whether stuck, bead, flush, sunk, pointed, etc.) and according to more explicit directions of the architect. No more mortar to be mixed at one time than can be used within one hour after mixing. All water and tools used for mixing shall be absolutely clean. No pointing shall be done in freezing weather or when work is exposed to hot sun, unless protected.

How to specify for laying floor tile:

On top of the structural floor or base, lay a $\frac{1}{2}$ inch bed of mortar composed of one part Atlas-White Portland Cement, three parts clean sharp sand, and one-tenth part hydrated lime. This mortar to be spread over a space of about six feet square only at one time and carefully leveled. On this bed of mortar lay the tile, which have first been well saturated with clean water. The mortar must be stiff enough not to work up between the joints.

After this work has been allowed to harden (two days is usually sufficient time) the tile are to be scrubbed with clean water, and the open joints thoroughly grouted with neat Atlas-White Portland Cement mixed with water to the consistency of thick cream. When this grout begins to stiffen, the excess mortar on the surface of the tile shall be carefully rubbed off and the floor left perfectly clean. (Although it is common practice to use neat cement for the grout, a thin mortar of one part Atlas-White and one part clean fine sand is sometimes used.)

How to specify for setting and pointing wall tile:

(No. 1) On the wall surface or base, spread a $\frac{1}{2}$ inch bed of mortar composed of one part Atlas-White Portland Cement, two parts clean sharp sand, and one-tenth part hydrated lime. This mortar to be spread over a space of about six feet square only at one time and carefully leveled and plumbed. On the bed of the mortar set the tile which have been well saturated with clean water. The mortar must be stiff enough to stay in place and not to work up between the joints.

(No. 2) Each piece of tile shall be well saturated with water and "buttered" on the back with mortar, composed of 1 part Atlas-White Portland Cement, three parts clean sharp sand, and one-tenth part hydrated lime. The tile shall then be set in place and tapped until firmly seated and plumb.

After this work has been allowed to harden (about two days is usually sufficient) the surface of the tile shall be well scrubbed with clean water and the joints filled with neat Atlas-White Portland Cement mixed with clean water, stiff enough to stay in place on the vertical surface. The excess mortar on the surface of the tile shall be thoroughly rubbed off and the work left perfectly clean.

NOTE: When mortar is to be colored, the coloring material should be mixed thoroughly while dry with the cement and sand, and until the mixture is uniform in color. The coloring matter should never measure more than one-tenth the volume of cement.

Atlas Service to Architects:

We have compiled valuable information on concrete and the uses of cement and shall be glad to coöperate with architects who so desire, in the solution of their problems in the best use of cement, in developing the most economical layouts for reinforced concrete construction and with other suggestions.

Publications:

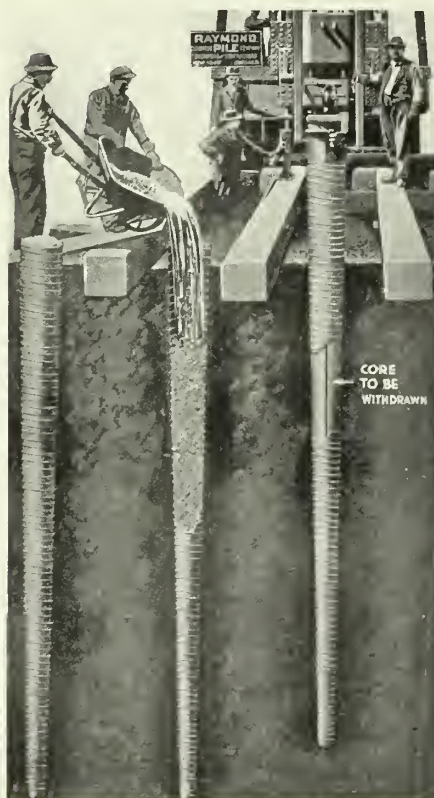
Early Stucco Houses (including stucco specifications)
Color Tones in Stucco (including stucco specifications)
Concrete on the Farm.
Concrete in Highway Construction.
Reinforced Concrete in Factory Construction.

Raymond Concrete Piles

How are they made?

Answers

- 1 A permanent shell is placed in the ground and is then filled with concrete; the shell protecting the concrete from distortion and damage.
- 2 The cost depends entirely upon the number of piles involved and local conditions at the site.
- 3 From 20 to 40 piles per eight-hour shift can be placed under usual conditions.
- 4 Raymond Concrete Piles can be placed as close as 2 feet 6 inches on centers.
- 5 Raymond Piles will support from 30 to 50 tons each, depending upon local Building Ordinances.
- 6 The average length depends upon the soil penetrated, and varies from 18 to 40 feet.



Raymond Method

- 1 A collapsible mandrel or core, measuring 8" in diameter at the point and increasing in diameter .4" per foot of length, is expanded.
- 2 This expanded core is encased in a sectional, spirally reinforced, sheet steel shell and is now ready for driving.
- 3 The combined core and shell is driven into the ground to sufficient penetration. The core is then collapsed and withdrawn from the shell.
- 4 The shell—which remains in the ground—is then carefully inspected as it is to be the receptacle of the GREEN concrete.
- 5 Carefully prepared concrete is now poured into the shell, thus forming a complete Raymond Pile, perfect from tip to top.

Simple, isn't it?

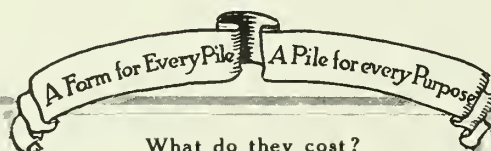
Raymond Concrete Pile Company

New York
140 Cedar Street

Branch Offices
in all Principal Cities

Chicago
111 W. Monroe Street

Raymond Concrete Pile Company of Canada, Ltd., Montreal, Canada



How are they made?
See Answer No. 1

What do they cost?
See Answer No. 2

How fast can they be placed?
See Answer No. 3

How close can they be placed?
See Answer No. 4

What load will they carry?
See Answer No. 5

What is their average length?
See Answer No. 6

ANNOUNCING THE

National Building Granite Quarries Association

INCORPORATED

TO afford aid and protection to the members thereof as an assembly of business men;

- promote and further the use and sale of granite for building purposes;
- secure the co-operation of the manufacturers of building granite in their relations with each other for the purpose of furthering the general welfare of the building granite industry;
- guard the common interest of members as affected by legislation;
- protect said members against oppressive, arbitrary, or unjust administration of unfair tariff laws, and against arbitrary and unjust discrimination of freight rates and classifications;
- gather and disseminate practical and useful information relating to building materials generally, and to building granite in particular;
- promote harmonious relations between employers and employees, for the purpose of furthering the use of granite in competition with other building stones and materials;
- promote and secure better and more uniform contract conditions;
- collect and disseminate credit information;
- stimulate the activity of invention both in processes and tools;
- purchase, own, hold, lease, convey, mortgage, pledge, transfr, or otherwise acquire or dispose of real and personal property, or rights of every class and description, or any interest therein necessary or desirable for carrying out the aforesaid objects and purposes.

The above extracts from the Constitution and By-Laws of this Association comprise its purposes and objects.

JOHN S. McDANIEL, Secretary

31 State Street, BOSTON, MASS.

LIST OF MEMBERS

Bodwell Granite Company, Rockland, Maine	The New England Granite Works
Booth Bros. & Hurricane Isle Granite Co.	Westerly, R. I.
208 Broadway, New York, N. Y.	The North Carolina Granite Corp'n
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North Jay, Maine	Webb Pink Granite Co. - Milford, Mass.
Mount Airy Granite Cutting Co.	Woodbury Granite Co. - Hardwick, Vt.
Mount Airy, N. C.	

MILFORD MASSACHUSETTS GRANITE

WEBB PINK MILFORD

WEBB WHITE MILFORD

WEBB BUFF MILFORD

WEBB PRODUCTS

Milford, Mass. Granite for Commercial and Monumental Buildings and Memorials. Rough, Cut, Rubbed or Polished.

DESCRIPTION OF WEBB GRANITES

The WEBB PINK MILFORD is a distinctive, warm-toned PINK granite, having a uniform distribution of clear, black spottings, which contribute to the clean, clear-cut appearance, which has made Milford Granite a famous building material. This granite does not take on a cold appearance, but grows warmer, more pleasing, as it ages.

The WEBB WHITE MILFORD has the same characteristics as the Webb Pink, except that the general cast of color is Creamy White, producing a clear, white appearance in the mass, without losing its warmth of tone. This granite does not darken with age, because of its unusual hardness and low absorptive tendency.

The WEBB BUFF MILFORD is a new product, similar in characteristics to the Pink and White, but having a predominating, soft-toned Buff background, which is peculiar to itself. This granite is adapted more particularly to special work, rather than to large work, as it requires careful selection and matching.

GENERAL CHARACTERISTICS

These Granites are hard, compact, close-grained granites, adapted equally well to fine mouldings and carving, or to bold members and large spaces.

COMPRESSIVE STRENGTH

WEBB MILFORD GRANITES rank as the strongest of building granites, having an average compressive strength of approximately 30,000 pounds to the square inch.

FACILITIES AND SERVICE

The WEBB PINK GRANITE COMPANY owns about 350 acres of Quarry Land in Milford, Mass. All the quarries are fully equipped with Electric Power, Compressed Air, and Heavy Duty Derricks.

The large Cutting Plant is fully equipped with electric cranes and crane cars, for handling, and the most modern devices and tools for Cutting, Sawing, and Polishing granite.

The Plant and Organization are planned for Service and Fine Workmanship. Time schedules are maintained religiously, Service being our specialty.

SPECIAL NOTE.—Monoliths and blocks of large size are readily quarried and finished; the only limit as to size and weight being that of transportation.

SOME CONTRACTS EXECUTED

NEW POST OFFICE, New York City.

McKIM, MEAD AND WHITE

WILMINGTON PUBLIC BUILDINGS, Wilmington, Del.

JOHN D. THOMPSON, JR.
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NEW EQUITABLE BUILDING, New York City.

E. R. GRAHAM

LEXINGTON STREET BUILDING, Baltimore, Md.

PARKER, THOMAS & RICE

UNION STATION, Baltimore, Md.

KENNETH MURCHISON

U. S. NATIONAL BANK, Johnstown, Pa.

MOWBRAY & UFFINGER

PEOPLES GAS BUILDING, Chicago, Ill.

D. H. BURNHAM & Co.

CENTENNIAL MEMORIAL MONUMENT, Chicago, Ill.

HENRY BACON

WEBB PINK GRANITE COMPANY
MILFORD, MASS.

Presbrey-Coykendall Company

198 BROADWAY
NEW YORK

Quarry and Works: Barre, Vt.

MANUFACTURERS AND
BUILDERS OF

Monuments and Mausoleums

Practically speaking, there is no standard specification for mausoleum work. The essential point to bear in mind first and last is that this class of building differs from almost any other in that it will never be inhabited. The building will stand practically uncared for or have to withstand the elements for a long period without attention. This demands a construction which will require a minimum of care, the best results being more readily obtained in a comparatively small building holding no greater number of catacombs than can be spanned in the roof by stones within the limit of transportation. A consideration of this will show that the building of very large, such as community mausoleums is more or less a wasted effort, as at best, owing to the construction their size calls for, they can have only a very limited life. The present-day condition of those hitherto in use in South America and some of the European countries, now being discarded, is a practical illustration of their futility.

The first part to give way under the stress of the weather is, of course, the joints, and by reason of this we avoid as far as possible all exposed joints on the base course or stylobate, as the case may be, and on the roof. Such joints as can not be avoided we make raised and cover with either bronze or stone. The same applies in a lesser degree to the joints in the wall. Where the architect feels that he must have a building in small units to give scale, this can be readily obtained by the use of false joints and still use large stones.

The rules of the Woodlawn Cemetery, New York, require for exterior walls that the stone be not less than 10 inches thick and hold their face size the full thickness of the wall. The only satisfactory material for the exterior walls is granite and the best interior finish is from the same material, but in most cases marble is desired for the interior at least, and wainscoting should not be less than 2 inches thick, doweled and set in cement mortar and securely anchored to walls. Ceiling slabs not less than 1 1/4 inches thick. These should be supported by bronze perforated rosettes anchored to the under side of the roof with bronze suspension rod and lewis.

Elaborate systems of drainage for the catacombs, especially those involving mechanical features, are not imperishable and little better than useless; in fact, the New York state laws do not allow any drainage systems from the catacombs, but insist that they be as far as possible separately sealed and all interments must be in metal-lined boxes hermetically sealed.

Excerpt from Woodlawn Cemetery Company's rules and regulations:

The catacombs should be at least 7'-6" long, 2'-8" wide and 2'-2" high in the clear. Catacombs which have marble fronts opening at the side may be constructed as follows: Ends 2" slate rabbeted on the inside rear vertical edges for back slate, and on the front vertical edges for the marble



JOHN R. HEGEMAN MAUSOLEUM

Just completed at Woodlawn Cemetery, Ferdinand Prochazka, Architect. Cut from light Barre granite at our plant in Barre, Vermont, and erected by us

tablet. The rabbets at the back should be 3/4" deep. The rabbets at the front should be 1/2" deep at one end of the catacomb and 1 1/8" deep at the other end to allow the tablets to slide back and be taken out. The rabbets for the tablets may be cut on the vertical stiles instead of on the tablets if so desired.

The backs of the catacombs to be 1" slate, shelves 2" slate, large enough to fully cover the top edges of rear and end slates. All four corners of the catacomb stack to be braced against the outside walls by brick piers. The marble tablets to be not less than 1" finished thickness. The posts or vertical stiles at the ends of catacombs to be not less than 2" thick by 5" wide, securely doweled or anchored at both top and bottom of the post and at the top of each catacomb. The rails to be not less than 2 1/2" thick by 6" wide and long enough to run back of the vertical stiles and lap 2" on the slate at each end, the back edge of rail rabbeted to rest at least 1/2" on top of the slate shelf, or both rail and shelf rabbeted. All parts to be set in cement mortar.

To avoid the bad effects of condensation, ventilation should be liberally provided, not only in the auditorium, but between the marble wainscoting and outer walls. Inlets should be provided in outside wall leading into the space behind catacomb stacks and wainscoting, and outlets provided in the ceiling of the auditorium and in the upper part of walls to cause circulation of air as much as possible.

We try to avoid the use of reinforced or large masses of concrete for any integral part of the superstructure or the support of roofing. Most problems can generally be worked out to use granite instead.

As for foundations, it has generally been found satisfactory to simply use concrete walls under the main building 6 feet deep and 4 feet deep under the catacomb stacks and flooring. The use of granite in one or more slabs for floor obviates the necessity of providing a foundation for the floor other than the walls, taking care of the catacomb stacks.

We are at all times willing to answer questions or assist architects in developing practical plans for mausoleums or monuments.

NORTH BANGOR SLATE CO.

BANGOR, PA.

QUALITY:

Bangor slate is renowned for toughness, durability, non-porosity, and fissility, or the quality of splitting readily. Plates as large as 7 x 5 feet may be split into $\frac{3}{8}$ -inch thicknesses.

COLOR:

U. S. Geological Survey, Bulletin 586, of 1914, says: "The slate is very dark gray and to the unaided eye has a fine texture and a very smooth cleavage surface with but slight luster. It contains some magnetite and is sonorous."

GRADES:

Genuine No. 1 Bangor Slate: The best roofing slate quarried in commercial quantities, as to smoothness, strength, and quality. Split to about $\frac{3}{16}$ -inch thickness, or thicker if desired, with smooth sides and square corners.

No. 1 Ribbon: Contains one or more "ribbons," so placed as to be covered in laying and presents a roof similar to No. 1.

No. 2 Ribbon: Contains several "ribbons," some of which cannot be covered in laying.

No. 2 Clear: A slate without "ribbons" and made from rough beds.

DIMENSIONS:

Thicknesses: Vary from $\frac{1}{8}$ to $\frac{3}{8}$ inch with $\frac{1}{16}$ inch as average.

Sizes: Range from 6 x 12 to 24 x 14 inches. This Company makes about twenty different sizes. Sizes best adapted to plain roofs are the large wide slates such as 12 x 16 to 24 x 14 inches. Larger sizes make less joints, use less nails, and are more quickly laid; therefore, are the most economical.

Strength: $\frac{3}{16}$ -inch thick slates give full weather-protection and are strong enough to be walked on.

Weights: $\frac{3}{16}$ -inch thick slates will weigh, on the roof, about 6½ pounds per square foot; $\frac{1}{4}$ -inch thick weighs 8¾ pounds. Actual weight of $\frac{1}{4}$ -inch thick is $\frac{3}{8}$ pounds per square foot.

SLATE FOR FLAT ROOFS:

A flat slate roof gives what we believe to be the most serviceable and economical roof, in the end. It is fire-proof, weatherproof, and affords a surface that is not injured by being walked on.

Costs: Slate roofs cost more than some others at first, but we believe they are cheapest in the end. Costs vary with freight rates, labor, and the size and thickness desired.

Sizes and Finish: Favored slates for flat roofs comprise 6 x 8, 7 x 9, 6½ x 10, 7 x 11, 8 x 12 and 9 x 13 inches all $\frac{1}{8}$ inch thick. For slate tile roofs we recommend 10 x 10 and 12 x 12 inches in size, and $\frac{1}{2}$ to $\frac{7}{8}$ inch in thickness as desired. The under surface of slate tile is planed. The upper surface may be planed or rubbed. The edges are sawed.

STANDARD SPECIFICATION OF THE NORTH BANGOR SLATE CO.

Adopted May 1, 1916, for

GENUINE BANGOR SLATE ROOFS FOR FLAT SURFACES

FOR USE OVER CONCRETE:

NOTE:—When incline exceeds one (1) inch to one (1) foot, special specifications will be furnished upon request. Specifications and diagrams for use over board sheathing will also be furnished upon request.

The roof deck shall be left, by other contractors, smooth, firm, dry, properly graded to outlets, and free from loose material, all ready for the roofer to proceed, as follows:

First. Coat the concrete uniformly with Specification Pitch.

Second. Over the entire surface lay two (2) plies of Specification Tarred Felt, lapping each sheet seventeen (17) inches over preceding one, mopping with Specification Pitch the full seventeen (17) inches on each sheet, so that in no place shall Felt touch Felt.

Third. Coat the entire surface uniformly with Specification Pitch.

Fourth. Over the entire surface lay three (3) plies of Specification Tarred Felt, lapping each sheet twenty-two (22) inches over preceding one, mopping with Specification Pitch the full twenty-two (22) inches on each sheet, so that in no place shall Felt touch Felt.

Fifth. Spread over the entire surface a uniform coat-

ing of WARREN'S NO. 144 GENUINE BANGOR ROOFING ASPHALT, using an average of fifty (50) pounds to one hundred (100) square feet, into which, while hot, thoroughly embed GENUINE BANGOR SLATE; grade—size— inches by — inches (grade and size to be inserted); Slate to be perfectly dry when placed.

Flashings shall be constructed as shown in detailed drawing.

The roof may be inspected before the Slate are applied by cutting a slit not less than three (3) feet long at right angles to the way the Felt is laid. The cut can be repaired by sticking five (5) thicknesses of Felt over it, and the spot will then be as strong as any part of the roof.

NOTE.—We advise incorporating the full wording of the specification and inserting roofing details in plans in order to avoid any misunderstanding. If an abbreviated form is desired, the following is suggested:

Roofing: Shall be a GENUINE BANGOR SLATE ROOF FOR FLAT SURFACE (for use over concrete) laid as directed in printed specification, issued May 1, 1916, or as printed in the Structural Service Book of the American Institute of Architects, Vol. I, 1917, page 204, using the materials specified, and subject to the inspection requirement.

PRODUCTS OF THE UNITED STATES GYPSUM CO.

PYROBAR GYPSUM TILE. For partitions, furring, vent ducts, and steel protection. Tested and recommended by the National Board of Fire Underwriters as a fireproofing material. It weighs 40% less than Clay Tile.

PYROBAR REINFORCED ROOF TILE. Made of Structolite (structural gypsum). The Tile are permanent and tests show that they excel any other fireproof roof as a nonconductor of heat. Their light weight and long spans save steel. They are very quickly erected.

PYROBAR GYPSUM FLOOR TILE. For long span, reinforced concrete joist floor construction. A thoroughly tested, economical fireproof floor system.

U. S. G. CEMENT PLASTER, to be mixed with sand at the job.

U. S. G. WOOD FIBRE PLASTER, requiring the addition of water only.

U. S. G. PREPARED (sanded) PLASTER, including Adamant Wall Plaster.

U. S. G. KEENE'S CEMENT. Made in two grades, "Regular" and "Fine." Equal in quality to imported Keene's.

U. S. G. PREPARED NO-LIME TROWEL FINISHES. These finishes are very much harder than lime putty finish, are easily troweled, are made in various grades, in white or gray colors, and require the addition of water only.

U. S. G. PREPARED SAND FLOAT FINISHES. Same as U. S. G. Prepared Trowel Finishes except that they have a granular surface.

U. S. G. GAUGING PLASTERS, for putty finish.

U. S. G. BOND PLASTER. A prepared material recommended for plastering interior concrete surfaces.

U. S. G. MOULDING PLASTERS.

AJAX CAEN STONE CEMENT. A substitute for genuine French Caen Stone.

IVORY HYDRATED FINISHING LIME. A high magnesium, snow-white lime from Genoa, Ohio.

SACKETT PLASTER BOARD. A heat-insulating, sound-deadening, fire-resisting lathing material.

JESTER SACKETT HOLLOW AND SOLID PARTITIONS AND SUSPENDED CEILINGS. An economical and thoroughly incombustible construction consisting of Sackett Plaster Board applied to channel irons.

SHEETROCK WALL BOARD. A uniform wall board of gypsum, made in lengths up to 10 feet. Doesn't warp nor burn.



Specifications for PYROBAR Gypsum Partition Tile

PARTITIONS.—Unless otherwise specified or shown, all partitions shall be built of UNITED STATES GYPSUM COMPANY'S PYROBAR Gypsum Tile, of thickness indicated on plans. All partitions shall be started on the fireproof floor, and the tile shall be set plumb, leaving both faces of partitions straight and true. All partitions shall be wedged at ceiling and slushed in with mortar.

FURRING.—All outside walls, where shown on plans, shall be furred with PYROBAR Gypsum Tile, of thickness and type indicated on plans, laid up against the wall, and where 2-inch solid or hollow furring tile is used, the same shall be securely spiked to the wall every square yard with 10d steel cut nails.

COLUMN PROTECTION.—All exposed interior columns shall be covered with solid PYROBAR Gypsum Tile, of thickness indicated on plans and in accordance with specifications.

SHAFTS, OPENINGS AND DUCTS.—Construct all pipe chases, dumbwaiter shafts, heating and vent ducts, etc., where shown on plans, with 2-inch solid PYROBAR Gypsum Tile.

MORTAR AND LAYING.—All PYROBAR Gypsum Tile shall be laid up in mortar composed of any brand of UNITED STATES GYPSUM COMPANY'S Cement Plaster—one part of plaster to three (3) parts of clean, sharp, dry sand, thoroughly mixed. No mortar shall be rettempered. All tile shall be laid with full flush joints to a line, with horizontal beds uniformly level on each course. Fill all joints, chinks and crevices between the tile and other work which shall be well slushed in.

FRAMES.—The carpenter contractor shall set the rough bucks for openings ahead of the contractor for this work, so as to cause no delay. These bucks shall be left plumb and true by the carpenter, and shall be made of 2-inch lumber of the same width as the thickness of the partition, and there shall be $\frac{3}{4}$ -inch by $2\frac{3}{4}$ -inch grounds nailed to the bucks forming a rabbet to receive the PYROBAR Tile. Anchor the partition at the wall by driving spikes into the wall in the joints at the top of each course.

PLASTERING.—Use U. S. Gypsum only (not Portland Cement or lime) applied according to directions of manufacturer.

Special literature describing any of the above mentioned materials sent upon request. We will gladly answer technical questions on roof, partition, or floor construction.

UNITED STATES GYPSUM COMPANY

World's Largest Makers of Gypsum Products

205 W. Monroe St., CHICAGO

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CLEVELAND

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KANSAS CITY

SAN FRANCISCO

Attention is directed to the

Federal Granite Terra Cotta

in the new

Public Service Building, Baltimore

Parker, Thomas & Rice, Architects

J. Henry Miller, Inc., Builders



THE four elevations are constructed solidly of this material from the fourth story dentil course up to and including the main cornice—one of the largest contracts ever executed in granite terra cotta.

The terra cotta reproduces exactly the color, texture and general appearance of the natural pink Milford Granite used in the lower stories.

Special attention is called to the size and straightness of the individual pieces of terra cotta.

Federal Granite Terra Cotta, in which this company specializes, is the result of many years' experiments. It has all the advantages of natural granite and greater durability and fire-resisting qualities in addition.

Manufactured by

Federal Terra Cotta Co.

Trinity Bldg., New York

Book Bldg., Detroit



“THE setter they (the Atlantic Company) furnished us, was worth twice the money I paid him, as he was the best man I ever had on Terra Cotta work, and a fine man personally to have on the building.”

We quote part of a letter from the Bankers Realty Investment Co., builders of the Blackstone Hotel, Omaha. It is typical of many letters we receive from contractors who engage one of our Terra Cotta setters to assist and direct the other masons in their Terra Cotta work.

*Let us write and explain this form of
Atlantic service in detail.*

Atlantic Terra Cotta Company
1170 Broadway, New York

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ST. PETER'S RECTORY, STATEN ISLAND, N. Y.

George H. Streeon, Architect

OUR business consists of the manufacturing of Architectural Terra Cotta, selling Bricks of all kinds, principally high-grade for Fronts and Interiors.

Also Hollow Tile Fireproofing, which we erect by contract or sell to the customer, as the occasion may require.

We also sell and manufacture Special Clay Roofing Tile.

All of these materials are handled by separate departments, each under the charge of a competent Manager.



ST. ALOYSIUS CHURCH, GREAT NECK, L. I.

G. E. Steinback, Architect

O. W. KETCHAM

24 South Seventh St.
Philadelphia, Pa.

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Baltimore, Md.

Home Life Building
Washington, D. C.

Terra Cotta Factory
Crum Lynne, Pa.

THE GORHAM CO ARCHITECTURAL BRONZE
FIFTH AVENUE NEW YORK

[illegible]

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WE UNDERTAKE AND EXECUTE, IN THE FINER ALLOYS, METAL WORK OF EVERY DESCRIPTION, FROM THE SIMPLEST ART OBJECTS TO THE MOST ELABORATE COLOSSAL UNDERTAKINGS THAT ARE POSSIBLE TO PRODUCE IN BRONZE, GERMAN SILVER OR GOLD.

OUR SERVICES AND PRICES ARE THE MOST ECONOMICAL CONSISTENT WITH GORHAM STANDARD OF EXCELLENCE IN BRONZESMITHING.

The Cutler Mail Chute



has been for more than a quarter of a century, and will remain, the standard of excellence in every respect.

It has received the highest award wherever exhibited, and is being furnished to all those who consider quality as well as price, at exceptionally low figures.

The construction now used by us has been developed in many years of experience exclusively in this field and our organization and facilities enable us to continue to furnish the very best work of its class at the lowest possible price.

We point to such mail chute work as that in the Woolworth, Equitable, Western Union, and other monumental examples of all that is best in building construction and equipment, and to our stock work of equal efficiency in thousands of buildings of less commanding importance in every part of the United States.

Agents in every important center.
Sweet's Index Pages 1726 and 1727.

CUTLER MAIL CHUTE COMPANY
ROCHESTER, N. Y.

A REPRESENTATIVE WILL CALL ON REQUEST

Service with a Purpose

THE service extended to architects by this association is an *organized* service—service carrying a definite purpose.

We do not attempt to force it. Its acceptance and its rendition must be in the same spirit.

Where such service is desired the complete facilities of the member companies, represented by the association—in the way of suggestions, samples, or with respect to any details involved in the purchase and application of tile—are at your command.

It is a service designed to be constructive and mutually helpful. We invite you to take advantage of it.

ASSOCIATED TILE MANUFACTURERS

BEAVER FALLS, PA.

ALHAMBRA TILE CO. Newport, Ky.	MATAWAN TILE CO. Matawan, N. J.
AMERICAN ENCAUSTIC TILING CO. Zanesville, Ohio	MOSAIC TILE CO. Zanesville, Ohio
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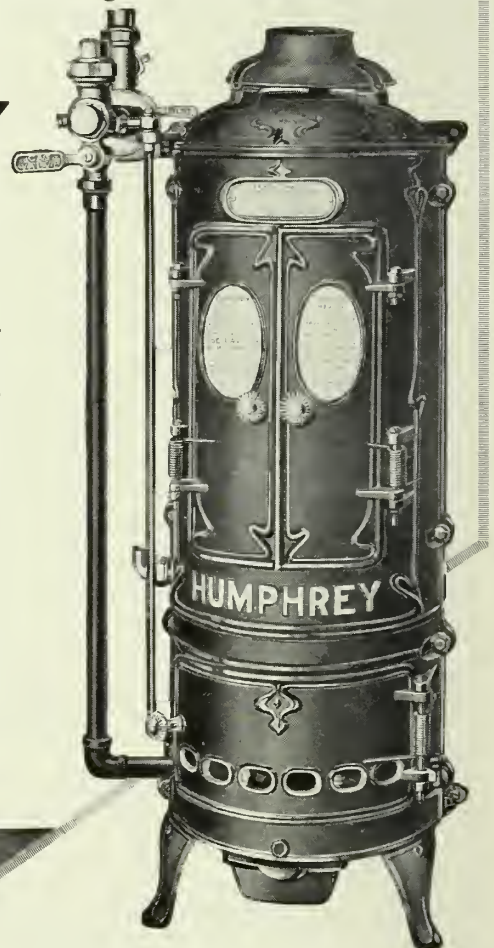
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Our Service Department is at your service. Please call upon it for any information.



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It was designed jointly by a famous Hospital Architect and an eminent Hospital Executive to overcome an unsanitary condition in a modern hospital. The functions of the

PFAUDLER Glass Enameled Steel LAUNDRY CHUTE

are to receive the infected, soiled linen at each floor, to convey it quickly, automatically and *safely* to the laundry without permitting its infections to spread, and to be easily and thoroughly cleansed with hot water by the turning of a valve.

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The plate glass and nickel doors present an attractive, sanitary appearance and close tightly against escaping infections and leakage of the flushing water. At the bottom the chute is connected to the drain.

Sanitary Water Storage Tanks

Pfaudler Glass Enameled Steel Tanks are being used very successfully for water storage in a large number of public buildings, hotels, and steamships. They neither leak nor rust, are non-absorptive and can not pollute their contents.

We do not know how long a Pfaudler Enameled Steel Chute or Water Tank will last, because none has ever worn out. Many Pfaudler Tanks installed 30 years ago are still in commission.

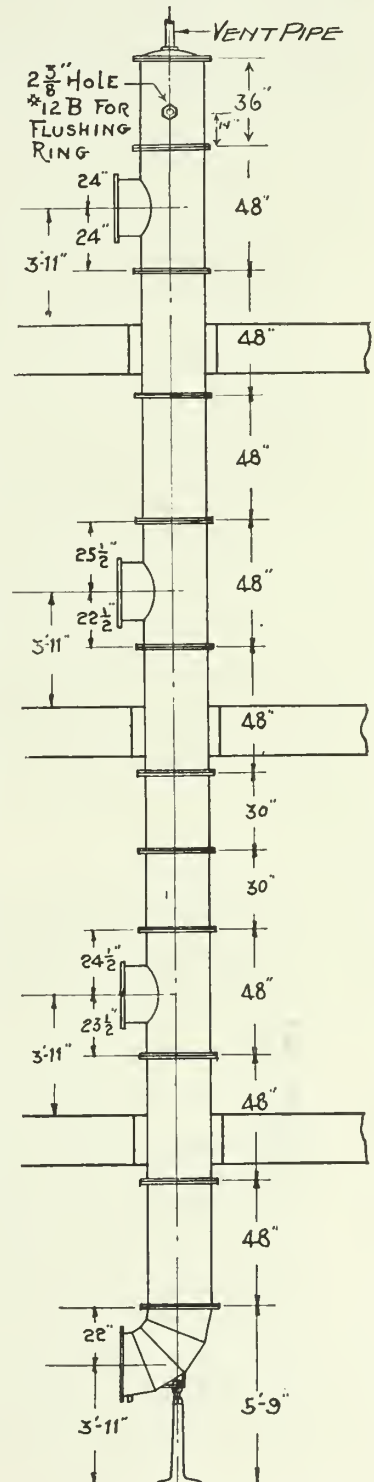
May we tell you more about them?

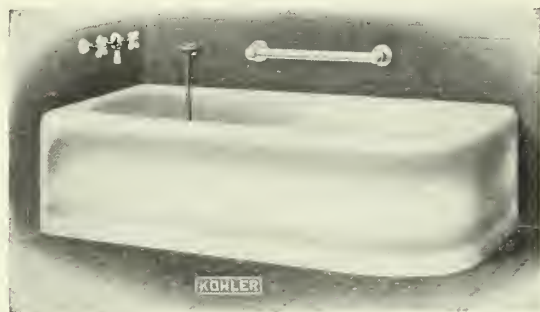
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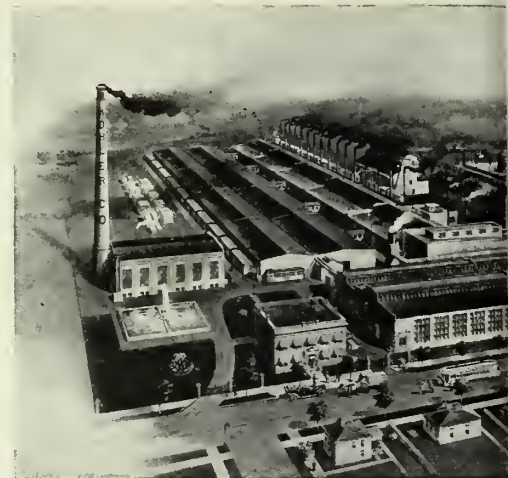
"Viceroy," Plate F-14-A
(Patent Applied for and Name Reg. U. S. Patent Office)



The "Bretton" Lavatory, Plate F-580-A
(Name Reg. U. S. Patent Office)



"Bevo" Lavatory, Plate F-271-FA



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Plumbing Ware has been developed in a few years ago to the high quality reputation

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always of one quality

The KOHLER line is a standardized line: all patterns not consistent with modern plumbing ideas have been eliminated.

The one-piece construction and simplicity of design make KOHLER WARE hygienic. The KOHLER pure white enamel is a result of years of study and experiment and is the crowning feature that con-

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Founded 1873

Kohler, Wisconsin



Plate



Kohler of Kohler

the Manufacture of Enameled Plumbing Ware

the crude, unhygienic fixtures of a
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tributes to the beauty and durability of KOHLER
WARE. Architects throughout the country recog-
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century ideas in sanitation.

Our trade-mark, the name KOHLER, is permanently
imprinted in the enamel of each fixture and is the archi-
tect's guide to excellence and our pledge of quality.

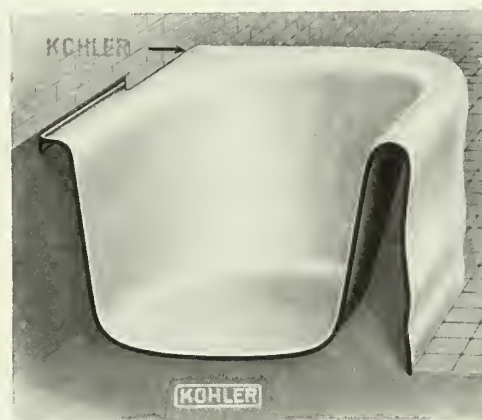


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Kitchenette Sink—Plate F-1008-A



Sectional View of "Viceroy" Bath Tub, showing parts built into wall and floor. Arrow points to permanent trade mark which is incorporated in faint blue letters in all Kohler products.



"Columbia" Lavatory, Plate F-205-A

Clean, safe, freshly-filtered Water

In Buildings of all kinds, and in Residences, water of this character is

A great protection to valves, pipes and mechanical equipment because the water is free from grit and dirt.

It is a great protection to basins, toilets, tubs, etc., because the water is free from discoloration.

It is a source of pleasure and comfort in the bathroom because the water is clear, sparkling, attractive and safe.

The value of clean, stainless water in the laundry and clean, safe water in kitchen and pantry is apparent.

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provide water of this quality and at the same time require very little care or attention. Their simplicity coupled with their substantial construction have won them wide success and approval by leading Architects and Engineers. The cuts below illustrate several sizes of this filter, designed to meet large or small requirements or varying conditions of water supply. Full information or the services of our engineering department are always gladly furnished.

The removal of discoloration from Hot Water is a specialty with us

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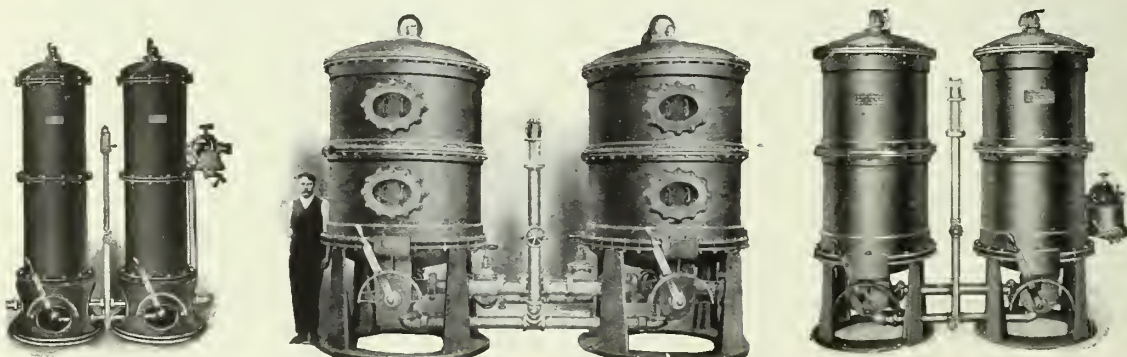
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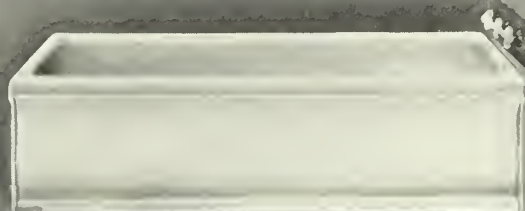
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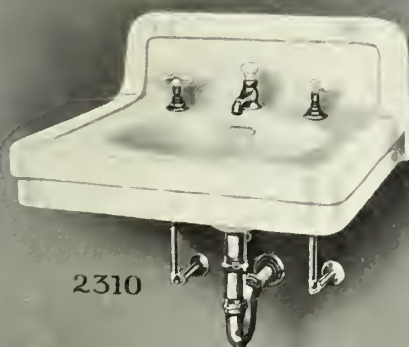
2125



2201



2261



2310

Pride inspiring, eventually economical because made from the materials that clean most easily and last longer than the house itself

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"Ideal" Solid Porcelain*

Build permanently, for the dignity of the home is reflected no more surely than by the appearance of the bathroom

Let the "Star Within the Circle" Trade Mark be your assurance that you are getting the best quality

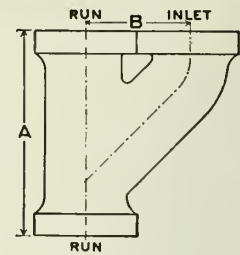
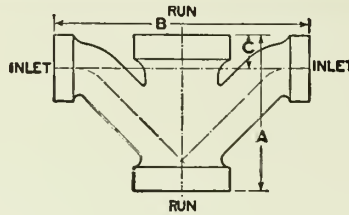
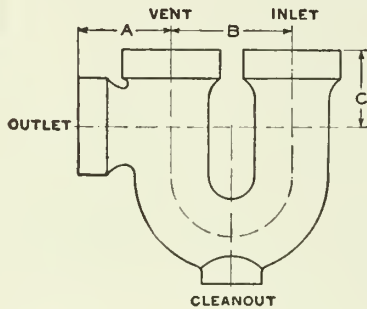


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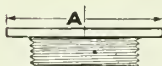
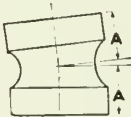
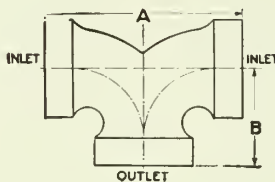
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Drainage

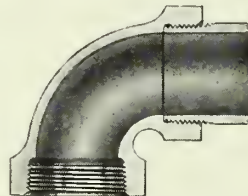


should have an unobstructed escape from the premises.

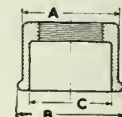
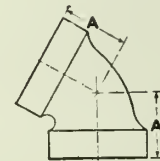
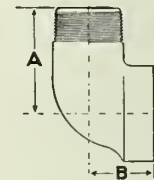
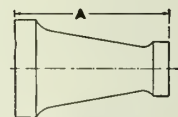
CRANE DRAINAGE FITTINGS



are made with a shoulder against which the pipe abuts so closely that all "pockets" are eliminated, thus affording the drainage a free and continuous flow to the sewer. As a further precaution against contamination, the interior of these fittings are as smooth as it is possible to make them. They are heavy and strong enough to safely withstand the strain of settling.



We have such a large variety of patterns and sizes that we can easily accommodate the drainage system of any building, regardless of size.



Malleable Iron Drainage Fittings made to order.

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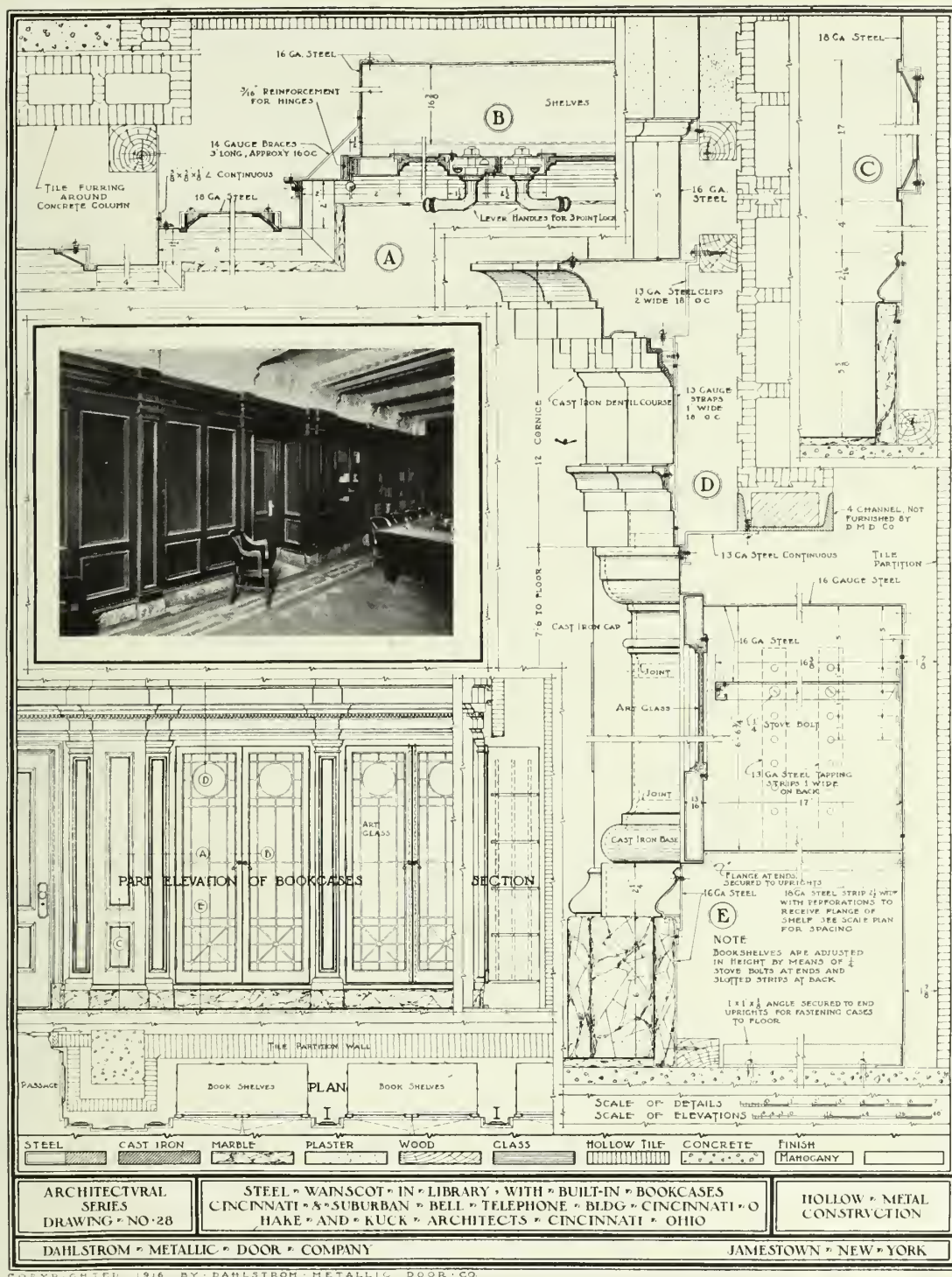
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Main Offices and Plant:
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Sedgwick Machine Works

124 LIBERTY STREET - NEW YORK CITY

Products

Hand-Power Dumb Waiters and Elevators of all types and for every purpose: Private House Dumb Waiters; Apartment House Dumb Waiters; Hospital Dumb Waiters and Elevators; Hotel and Restaurant Dumb Waiters; Library Book Lifts; Fuel Lifts; Brass Tube Dumb Waiters; High Speed, Automatic Brake, Bank Brake, and Geared Dumb Waiters; Trunk Lifts, Invalid Elevators, Domestic Elevators, Freight Elevators, Sidewalk Elevators, Carriage Elevators, Automobile Elevators, Ash Hoists, Hatchway Hoists, etc.

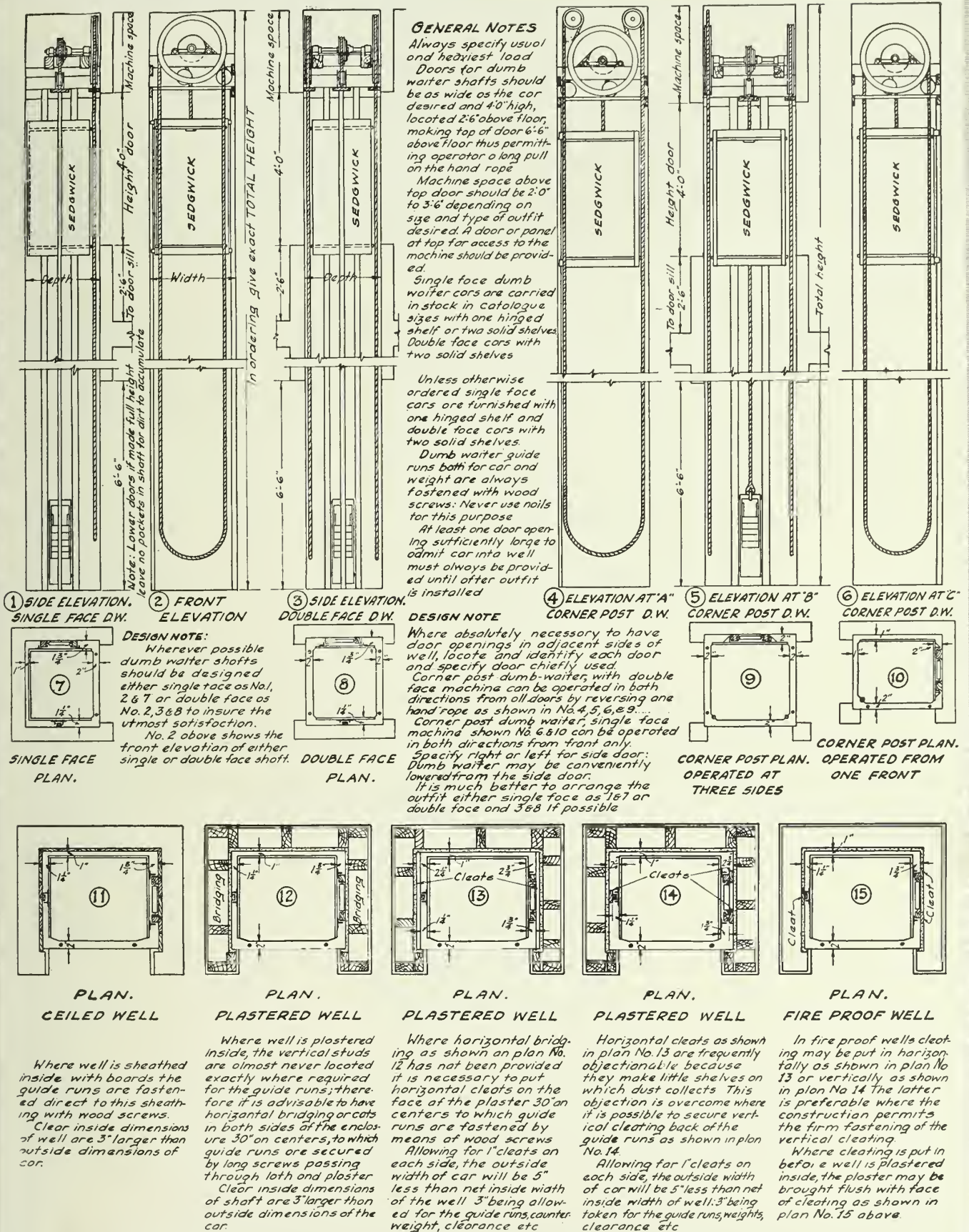
Complete catalogue or special descriptive matter sent upon request

STANDARD SPECIFICATIONS

- I. The Dumb Waiter shall be furnished and installed (strike out "and installed" if installation is to be by local mechanics) by the Sedgwick Machine Works, of 124 Liberty Street, New York, and must comply with the following specifications:
 - II. The Dumb Waiter is to operate between the floor and the floor, a total height over all of feet.
 - III. It must be designed for satisfactory service with loads averaging pounds and must be strong enough to carry occasional or test loads of pounds.
 - IV. The Car shall be inches wide right to left and inches deep front to rear (outside measurements) and shall be fitted with one hinged shelf (or two solid shelves if preferred) in addition to the top and bottom. (For double face cars we recommend two solid shelves besides top and bottom.)
NOTE—Or, if preferred, specify: The car shall be made to suit space inches wide right to left and inches deep front to rear, and shall be fitted, etc., etc.
 - V. It shall be of selected Ash Lumber, seasoned for three years in the open air under sheds in the yards of the manufacturer, and kiln dried just previous to being worked up.
 - VI. The sides shall be tongued and grooved and jointed, and blind bolted into the cross frames.
 - VII. All exposed screws shall be piano screws, and the screws holding bottom to sills shall be concealed by wood plugs.
 - VIII. The Top and Bottom and all solid shelves shall be rebated into the sides.
 - IX. The Machine shall be of the full Automatic Brake Type, so that whether counterweight be placed at the right or left, the machine will automatically hold the load.
 - X. The Machine shall be fitted with Improved Steel Anti-Friction roller bearings in every bearing; The Brake Plate shall be of Phosphor Bronze, having its opposite faces ground and polished true and parallel to the thousandth part of an inch; This Brake Plate to be held rigidly in place by two steel shafts each $\frac{5}{8}$ inch in diameter, which rods shall have their ends socketed and secured by set screws in the main front and rear frames of the machine, thus keeping the main frames and bearings and the Automatic Brake exactly and permanently in line.
 - XI. The Automatic Brake shall be provided with two steel Adjusting Bolts for taking up wear, fitted with steel Lock Nuts and each having two semi-spherical phosphor bronze washers fitted to semi-spherical sockets in the brake members, so as to give a perfect bearing in all positions.
- NOTE—If Band Brake machine is wanted, substitute for IX, X and XI the following:
- IXA. The Machine shall be fitted with Improved Steel Anti-Friction Roller Bearings in all bearings, and shall have its front and rear frames rigidly held in line by three steel rods each $\frac{3}{4}$ inch in diameter.
 - XA. The Brake shall be fitted with a Steel Brake Band, lined with vulcanized fibre, and shall have a toggle jointed operating lever which, when fully applied, shall automatically lock so that
 - XIA. A slight pressure on the brake line shall partially apply the Brake and control speed of car in lowering, while a final pull shall stop and lock the outfit, an upward pull on the brake line being required to release the brake.
- NOTE—If the Simplex Dumb Waiter is wanted, substitute for IX, X and XI the following:
- IXB. The Machine shall have babbitted bearings and be supplied with a spring check for holding the load.
- NOTE—If a geared outfit for usual loads in excess of twenty-five pounds is required, use either IX, X and XI or IXA, XA and XIA and the following:
The Hand Wheel and the Lift Wheel shall be on different shafts, connected by strong, smooth running, machine moulded gears giving proper ratio of hand rope travel to travel of car, so that the specified load may be lifted without excessive effort.
- XII. The Machine shall be guaranteed for five years by the manufacturers, who shall make repairs free of charge during that time if returned to the factory express prepaid.
 - XIII. The Counterweight shall be adjustable, having smoothly fitted steel lugs running in grooves of the guide runs. No part of the body of the weight shall be permitted to touch the guide runs.
 - XIV. The Guide Runs to be of selected straight grain North Carolina Pine, free from knots and all imperfections, and worked in a moulding machine.
 - XV. The Hand Rope shall be of selected fine fibre Russian Hemp, four strand with heart.
 - XVI. The Car Rope shall be of selected pure long fibre Manila Hemp, four strand with heart.

Specifications (Short Form)

Specify as follows: "The Dumb Waiter (or Elevator) to be manufactured and installed by the Sedgwick Machine Works, 124 Liberty Street, New York." Thus all contractors may figure on the same equipment, the owner gets maximum value, and the architect has our guarantee that the outfit will be satisfactory and the work properly done. If local mechanics are to install, simply omit the words "and install."



The above show various Single Face Dumb Waiter enclosures, having all door openings in front. The car in a single face well is three inches less in depth than the depth of the well from the front to the rear. In Double Face wells, construction and arrangement are the same except that an extra inch is required between the fronts for the second hand rope. In Double Face wells therefore the car is four inches less in depth than the net inside measurement of the well from front to front.

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UNDER THE
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NEW YORK. June 28, 1917.

Central Foundry Co.,
90 West Street,
City.

Dear Sirs:-

At the present time, we are completely overhauling the building #799 Park Av., City, which was constructed some twenty six (26) years ago.

Our contract with the owners, permits us to use all pipe etc. found in good condition.

The cast iron of this building is in such good shape, we will use same over again. After explaining these facts to your Mr. W.A. Crotty, he advised us to write to you giving you the information, knowing it might be of interest to you to know about same.

If you care to visit the building and get samples of the pipe we will be glad to arrange for your representative to meet our man.

In our opinion, it vindicates the statement we have made for many years, viz., "Cast iron is more serviceable than wrought iron for waste and vent".

We trust this will be entirely satisfactory and of some interest to you, we are,

Very truly yours,

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POLLACK & O'NEILL, Inc.

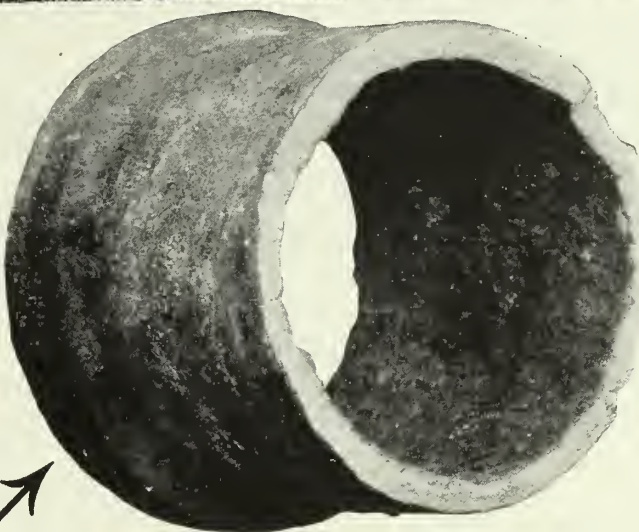
Per John C. O'Neill.

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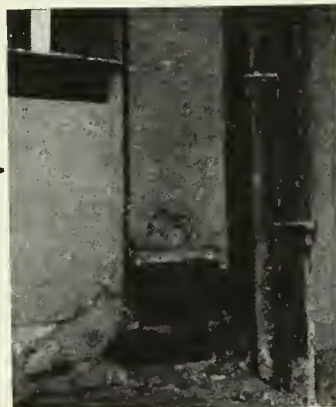
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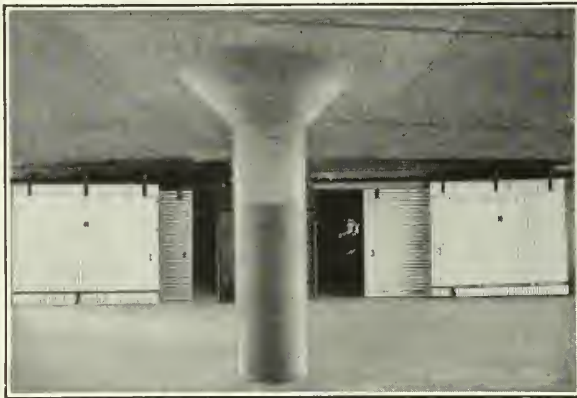
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serviceable than
wrought iron for
waste and vent'**



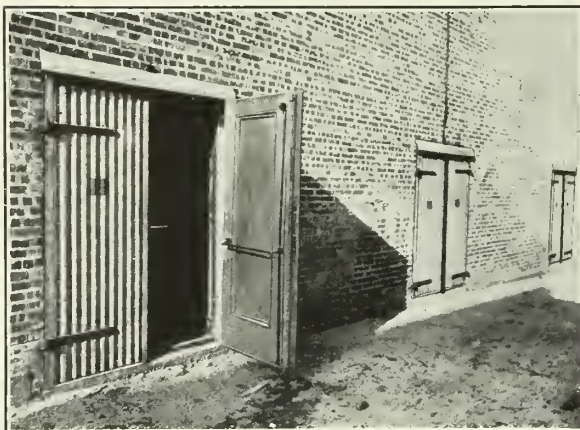
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Wire Rope Works, Trenton, N. J.



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Installation showing addition of Metal Trim for Interior Finish

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Of rigid, all-steel and asbestos construction, they are light in weight, cost very little to maintain and secure the lowest insurance rates.

They have been adopted by the United States Government for use in the Panama Canal Zone besides being used by such prominent industrial corporations as the Pennsylvania Railroad, New York Central R. R., Liggett & Myers Tobacco Co., Roebling Wire Works, and many others.

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An Investigation of Pipe Corrosion

Showing service records of iron,
steel and brass pipe used for
hot and cold water supply lines
in 125 Pittsburgh Apartment
Buildings.

by Thomas F. Payne
Sanitary Engineer formerly Instructor in
Plumbing, Carnegie Technical Institute
and Superintendent Specialty Department
Standard Sanitary Manufacturing Co.

Bulletin No. 30, size 8½" x 11", 16 pp., containing a complete report on this investigation, will soon be published. It gives the names of 125 old apartment buildings, the kind of pipe installed, when installed, amount of repairs and replacements to date in hot and cold water mains and risers. The life of iron, steel, and brass pipe in hot water mains is clearly indicated by the law of averages, and a great mass of other specific information of the greatest value is brought to light.

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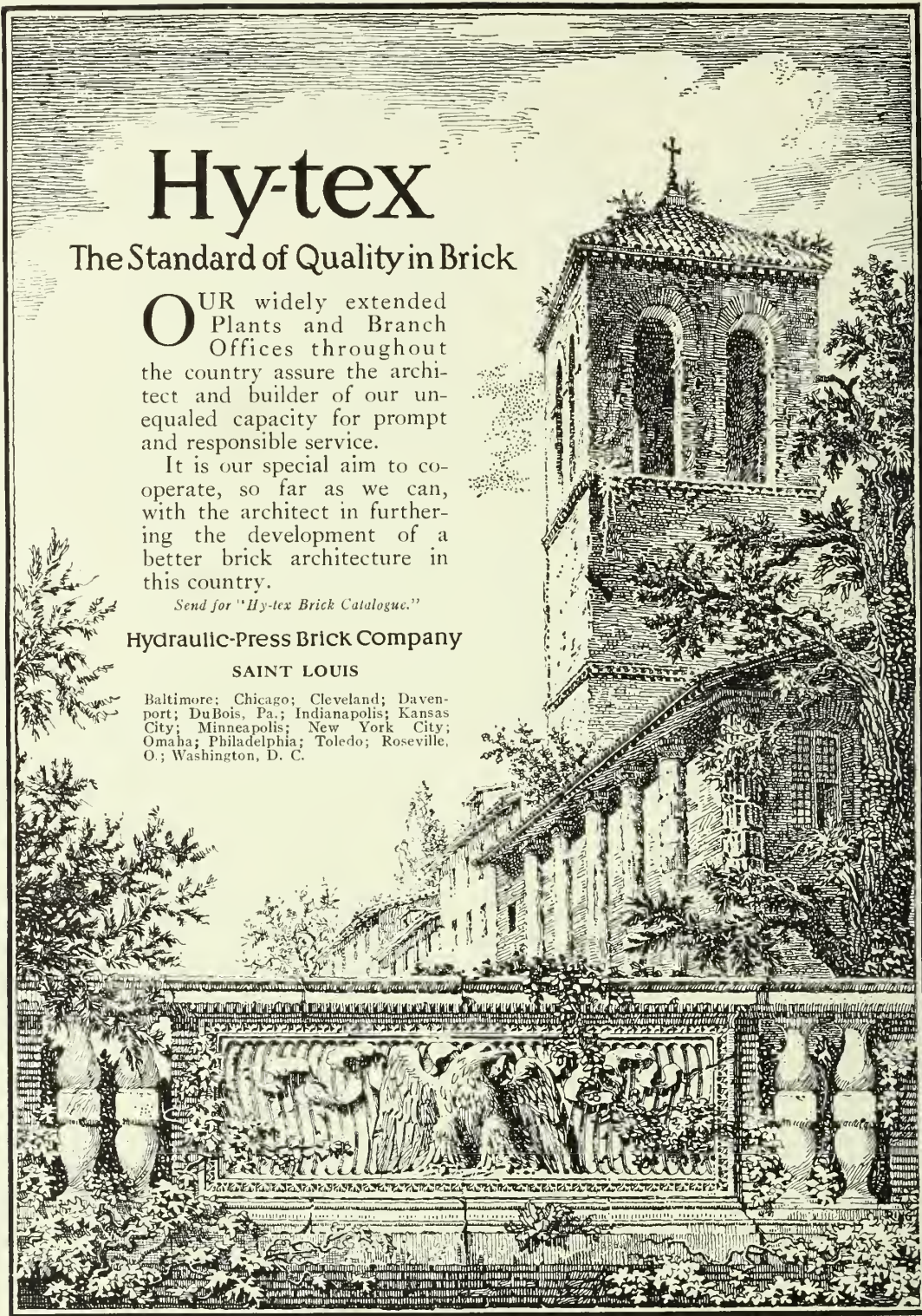
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